MODERN REQUIREMENTS

in

ISOLATION HOSPITAL CONSTRUCTION AND ADMINISTRATION

by

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C O N T E N T S.

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CHAPTER I.

HYPOTHESIS

"The Art of a thing is, first, its aim, and next, its manner of accomplishment."
C.N. BOVEE. Summaries of Thought, Art and Artists.

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The first conception of a need for the Isolation Hospital was based upon a desire to separate the infected sick from the remainder of the community. This, in the early days of the hospitals, seemed the ideal method of checking the spread of epidemics; how disappointing in their actual effect, in this direction, they proved to be is well shown by the literature of the end of the nineteenth century. The idea of safeguarding the non-infected was not a new one, dating back to the ninth century, as will be shown subsequently.

As, however, the realisation came that the Isolation Hospital had failed to check the spread of infections to any great extent, the aim of "treatment" for such conditions became of chief importance.

Recently a third factor has arisen, namely, what is described by Parsons[1)] as the "Social Factor". That is the right of/

the right of any patient suffering from an infectious disease to have adequate treatment for his condition in the municipal fever hospital. Whereas it was formerly with great unwillingness that a parent would allow his child to be removed to hospital, it has now come to be realised that, from the point of view of treatment alone, the patient is, in many instances, better removed from his perhaps unsatisfactory home surroundings.

The limitation of accommodation in fever hospitals has led medical officers to give preferential treatment to certain diseases, such as diphtheria, scarlet fever, enteric fever, erysipelas. Meantime there have been noted changes in the incidence and rate of mortality of infectious diseases, and also in the methods of prevention of the occurrence of diseases, notably diphtheria. Enteric fever is now seldom seen. Scarlet fever incidence remains high but the disease is occurring in mild form at present. There is reason for the assumption that with an increase in facilities for active immunisation against diphtheria, the incidence of and mortality from this disease should rapidly diminish.

On the other hand, there is a high mortality from the respiratory/

the respiratory conditions, namely pneumonia, measles and whooping-cough, and it would appear that much more could be done with regard to the hospitalisation and treatment of those conditions. Taking the years 1917 - 26 inclusive there were 10,672 deaths from Scarlet Fever in England and Wales, but in the same period there were 58,292 deaths from Measles, and 392,942 deaths from Pneumonia. [1)]

In Scotland during 1933 there were 38,887 notified cases of Scarlet Fever with 310 deaths, while in the same year, of 10,953 known cases of Whooping-cough 762 died. [2)]

If then, "treatment" has to be the aim of the medical officer, it would appear that if preferential admission to hospital is necessary, closer regard must be made to the incidence and severity of diseases in the locality surrounding the hospital.

In a recent work on the nutrition of school children, Charles[3)] points out that during the years 1923 - 32 the case mortality rate for Measles per 100 notifications of Measles and Rubella is three times greater in the over-crowded areas than in the residential areas of Newcastle-on-Tyne, and he/

and he calls for the "provision of more abundant hospital facilities for the treatment of severe and complicated cases of Measles and Whooping-cough, and of patients from over-crowded homes." He goes on to state "that arrangements for the institutional after-care of these cases during convalescence would do much to reduce subsequent ill-health and invalidity."[3]

Again, McGregor in a discussion at a meeting of the Society of Medical Officers of Health, recently, states that the pneumonic complications of Measles and Whooping-cough in the poorer districts might be six or eight times as great as they were in the better quarters of the city.[4]

Except in the very large centres little is being done for complicated cases of Measles and Whooping-cough by way of hospital treatment. Provision has been made for some years back in several of the Scottish Hospitals, but it is only of recent years that interest in this has arisen in England.

According to Banks,[18] in a survey of the hospitals in 1932, "the isolation of endemic infectious disease has failed materially to reduce their incidence. The continued existence/

continued existence of fever hospitals can be justified economically only if efficient treatment is given". He proceeds to point out the fact that most hospitals are badly constructed from the point of view of proper isolation, give insufficient scope of open air treatment, and ample scope for the occurrence of cross-infection. "Hospital treatment of Broncho-pneumonia, especially that following Measles and Whooping-cough is," he believes, "a measure of real economy, being of high value in the prevention of permanent disability."

Apart from these considerations, there is a real need of proper means of isolating a variety of diseases which are not suitable for home or general hospital treatment, viz Erysipelas, septic throat conditions, puerperal sepsis, ophthalmia neonatorum, mumps, the infections of the nervous system, etc.

Many present-day hospitals do not provide adequate accommodation for a sufficient variety of conditions, however willing the medical superintendent might be to receive them.

A consideration/

A consideration of these facts, therefore, has lead to the formation of the present hypothesis, namely, that "the present system of construction and administration of isolation hospitals is, from the point of view of treatment of the killing diseases, not satisfactory, and that, having failed in the original attempt to check the spread of infectious disease by means of the hospitals, we should pay due regard to this new conception of the uses of the isolation hospital".

No advantage is gained, however, in merely declaiming the merits of what is, after all, a very great and important public service, unless we are prepared to suggest lines along which improvements might be made, and to this end, in the present study a survey of the modern literature with regard to the aetiology, mortality, and morbidity of the major infections has been coupled with visits to a representative number of isolation hospitals to consider present facilities for treatment of a greater variety of infectious diseases.

The writer has had personal experience of many of the difficulties of administration and treatment of zymotic diseases, and is aware of the difficulties attending the principle of selective admission to hospital, but has made an attempt to/

an attempt to assess the value of present methods and to trace lines along which the future policy of the isolation hospital must be guided.

There are, moreover, many allied factors to be considered, such as the changes taking place in modern housing conditions, and in the supply of nourishment to children in the poorer areas of cities; the increasing urbanisation of the populace; the progress which has been made in the field of prophylactic immunisation; the increase in facilities for travel, and the consequent speeding up of the conveyance of infection.

The subject is necessarily a vast one, and the literature extensive. It is necessary, therefore, to concentrate on those issues which have a direct bearing on modern hospital administration and construction.

The scheme followed here will be to give first of all a brief historical survey of the growth and development of the hospitals, followed by a summary of the present conception of the aetiology, mortality, and treatment of the major infections. Thereafter, the hospital is considered as a unit in the public health service from the points of/

points of view of (a) Construction and (b) Administration.

Lastly, a summary of the essential features from both these points of view is made, and consequent on this, an attempt made to trace the future policy of the hospitals.

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CHAPTER II.

HISTORICAL REVIEW

"Examine History, for it is 'Philosophy teaching by Experience.'

CARLYLE. Essays. On History.

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Although the plague was known in these islands as far back as 664 A.D. (Beda's History, Irish Annals),[6] the first hospitals for the reception of the infectious sick were the leper hospitals or "lazar-houses" of Norman times. The first of these was founded at Harbledown, Canterbury, by Archbishop Lanfranc before 1089, and was shortly followed by St. Bartholomew's of Rochester, Kent.

True, there were hospitals in pre-Norman times, but these were really guest-houses, (Hospes - a host or guest), or wayside shelters for all comers. These were indeed chivalrous times, and hospitality to strangers or pilgrims was looked upon as a solemn duty. Two such "hospices" were known in Yorkshire (925 A.D. - 940 A.D.) and St. Wulstan founded one near Worcester.[5]

Thus, although/

Thus, although Leprosy was common amongst the Franks in the 8th. century A.D., and is reported to have been brought over to England by the Crusaders, it might be more accurate to state that Leprosy was increased in England by the Crusades. [6] Edward the Conqueror cured one, while Hugh D'Orivalle, Bishop of London, died a leper in 1085. Geoffrey de Vinsauf, chronicler with Richard I. described a "dropsical sickness" which may have been Leprosy. [5]

The hospitals were founded, in the main, by the Church, which also created the Statutes relating to them. Others were founded by private enterprise, and were endowed by the patron, e.g. Richard Whittington, Henry III, etc. [5]

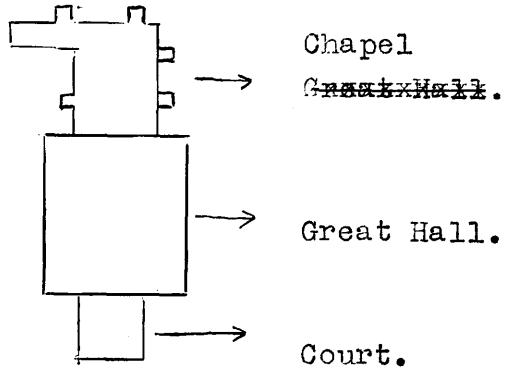
The Bishop was the administrator while the King acted as protector, in the guise of the Knights, Hospitallers, and Templars. The typical lazar-house consisted of a group of cottages, with an adjoining chapel surrounding a green enclosure, for "the relief of divers persons smitten with this sickness, and destitute, and walking at large within the realm". [5]

The plan of the hospital building adhered to one or other of four schemes, viz;/

one or other of four schemes, viz:-

(1) A great hall - the infirmary or dormitory with the Chapel at the eastern end.
(2) As before, but with the Chapel detached and entered from without.
(3) A quadrangular suite of buildings - with Chapel apart.
(4) As in (3) - with a narrow court-yard in front.

It is interesting to note that cubicles, separated by wooden partitions were in use in Higham Ferrers in 1423. There were upwards of 50 such hospitals in England in the Middle Ages. The following rough plan is of St. Mary's, Chichester. 5)



The leper wore a bell, and distinctive dress. He must not visit places of public resort or eat or drink with those that were well. He must pass to leeward and must not touch /

and must not touch infants or young children.[7]

By a decree of 1346 lepers were compelled to enter hospital, a proceeding which led to many hardships. Again, by a Norman edict "the mezel cannot be heir to anyone".[6]

Note at this stage three important points (a) the use of cubicles (b) the realisation of the infectivity of disease (c) the compulsion of entry into hospital. There is also the use of the word 'mesel'. Creighton states that measles as we know the disease, was confused with leprosy and that lazar-houses were also known as meselcotes,(Norman-French - Mesles).[6]

Leprosy raged from the 11th. century to the middle of the 13th. century, when it abated. It was considerably less after the middle of the 14th. century and had practically died out by the 16th. century save in the extreme south-west of England.

Gradually the lazar-houses died out as a result of poverty and mis-management. The number of lepers had been considerably lessened by the Black Death of 1349; indeed, the whole population was reduced by from half to two-thirds. In 1410 the Commons petitioned Parliament of Westminster that/

Parliament of Westminster that the surplus wealth of ecclesiastics might be transferred to other uses, and that destitute persons might benefit by the provision of new hospitals. Thereafter, the hospitals were dissolved one by one and a new era was entered upon, heralded by the re-founding of St. Bart's of Smithfield by Henry VIII in 1544.

The first illnesses known in England and Wales were Sweating Sickness, the Black Death, Leprosy, Scurvy and Whooping-cough,[8] although it is highly probable that many cases of so-called leprosy were in reality cases of Lupus, Chronic Eczema, Syphilis and Impetigo. It is interesting to note that the Swedish lazar-houses survived the Reformation, thanks to Gustavus Vasa. Dominican and Franciscan friaries were transformed into hospitals, and the then leper-houses became places of isolation for the infectious diseases.[5]

England was ravaged with the plague in 1349, 1603, 1625 and 1665. Many were the devices adopted to fend off the dread illness, such things as herbs being worn for protection. Herbs are still placed in front of the judges at the Old Bailey![9] Carts were used for the removal of the/

removal of the dead, the bodies being thrown into large pits. Many cases of the plague must have been received at this time into the general hospitals, as can be ascertained from the Journals of St. Bart's where it is recorded for Sept. 12th. 1665 that the Governor "thereupon ordered that the said Mr. Thomas Gray shall be permitted to officiate the cures and business for the plague in this hospital....." The governors thanked the Matron for her services during the plague. [10)]

There also sprang up hospitals specially for those sick of the plague. These, which were not municipal, but provided independently by parishioners, came to be known as Pest Houses, and, in this connection, it is noteworthy that at Sevenoaks an old house, named 'Pest House', was occasionally used for isolation purposes as late as 1892. [11)]

In 1519, the chief illnesses were Plague and Sweating Sickness, that curious disease which many suppose to have been in reality Influenza.[12)]

In 1603 an Act (1 Jac.1.c.31) made it an offence for a person infected/

a person infected with Plague to walk abroad (Encyc. Brit. 11th.Ed.).

Towards the close of the 17th. century Smallpox became the chief scourge of the population, and in 1713 the Lady Montagu introduced the method of Variolation. Later came the work of Jenner in 1795, and the first great step in the field of Preventive Medicine.

The first definite establishment of fever hospitals, was, however, due to the outbreak of typhus fever at the close of the 18th. century. The first of these was founded at Chester by Dr. Haygarth. Fever wards also came into use in general hospitals about this time. The London Fever Hospital was founded in 1802, but previously the London Smallpox Hospital (1745) and the Lock Hospital for Venereal Diseases (1746) had come into being. These were generally known as "Houses of Recovery", and were build by private enterprise.[11])

It will be opportune to mention here the first records of some of the other common infectious diseases. Varicella had been described (Riviere 1660) and had been confused with Measles till the work of Heberden 1767 established the difference.

Measles ("Hhasbah" of old times - according to Hirsch) was described by Forest in 1563.

Scarlet Fever/

Scarlet Fever was not described before the 16th. century and was early on confused with Measles till Sydenham (1661-1675) established the identity of Scarlet Fever as a separate entity.[13]

Interest in Preventive Medicine had taken concrete form by 1847 when Liverpool appointed the first Medical Officer of Health, Dr. Duncan, giving a lead even to London, which, however, followed by appointing Dr. John Simon M.O.H. in 1848.

Notwithstanding the foundation of the London Fever Hospital, Cholera was admitted to St. Bart's even in 1849.[10]

Interest in the causation of the zymotic diseases became more advanced. Little alteration of knowledge had taken place since the ancient Humoral Pathologists Hippocrates and Galen looked on disease as a contest on the part of Nature to expel from the system a super-abundance of one or other of the four humors - blood, phlegm, yellow or black bile. The Solidists, Fernelius, Hoffman and Cullen had regarded it as due to changes in living solids.

Writing in 1862, Murchison stated the cause of zymotic diseases to be/

zymotic diseases to be "degraded offspring of some kind of normal living matter, incapable of returning to its previous healthy state, but capable of being developed 'de novo' in persons or animals living under conditions adverse to health". [14]

It must not be thought that fever hospitals were established without a great deal of opposition and criticism from the general public. Indeed, one local authority reported the practice as being " a crime against humanity and a disgrace to the age in which we live". Many were the controversies raging round the classification and causation of the continued fevers and these are described fully by Murchison in his book. [14]

The foregoing serves to emphasize the tremendous changes that have taken place in our knowledge and outlook during the past seventy-odd years.

Diphtheria was defined as a separate disease from Scarlet Fever about 1856-59, although a disease, Pestis Gutturuosa, or Plague of the Throat, had been described by the St. Alban's chronicler (1315-16). [6]

The next great step was the foundation of the Cholera Hospitals. By Sect. 5 and 6/

By Sect. 5 and 6 of the Diseases Prevention Act of 1855, it was decreed that "wherever any part of England is threatened with Cholera....." the General Board of Health, later the Local Government Board, had power to "issue directions and regulations for guarding against the spread.....of cholera". By this the local authorities could, and did, provide accommodation for reception of the sick on an order of their medical officer of health. In 1866 Cholera again raged in London. Several local authorities built and maintained so-called "Cholera Hospitals".

The Metropolitan Poor Law Act of 1867 gave Unions and Parishes the power to combine for the purpose of setting up Poor Law Infirmaries. In this we see the beginnings of the Metropolitan Asylums Board. The Poor Law Infirmaries in places outside of London had wards attached for the treatment of fevers. 11)

Many were the arguments about the value of treating fevers separately. A circular issued in 1860 for the London Fever Hospital, found that eight general hospitals in London admitted a limited number of fever cases into the general/

the general wards. of 20 hospitals in the provinces , nine refused to admit fever cases, six admitted them to separate wards, and only five allowed them into the general wards. In every one of four Scottish hospitals separate fever wards were provided. Of five Irish hospitals, one was limited to fever cases, three had separate wards, and one mixed the cases.[11)]

Amongst the arguments put forward against the fever hospitals was the fact that concentration of the poison would lead to injurious results. Also there would be increased danger to the staff. This latter, however, would appear to have been the only stable argument. Ferriar (Manchester Infirmary) stated that "since establishing fever wards, and adopting removal of the patient on the first day of the disease, the spread had been cut down". Graham of Edinburgh favoured mixing the types of case providing the proportion was kept low.

The danger to the individual case was contradicted by facts. [14)]

The smallpox epidemic of 1869 "taught plainly the lesson that/

lesson that these, the only hospitals provided by the State for the treatment of paupers suffering from Infectious Diseases, could not be restricted to this class of person." 15)

The Poor Law Act of 1879, therefore, empowered the Metropolitan Asylums Board to contract with Local Authorities for the treatment of persons not paupers, and to recover expenses, and transferred the care of Workhouse Infirmaries to Sanitary Authorities.

Hospitals were still regarded as a potential source of danger to the populace, and an action was brought against Hampstead on the grounds that their hospital was the source of an outbreak of smallpox in the neighbourhood.

Definite views as to the epidemiology of diseases were being expressed, however, and of particular interest is that of Thomas 1875 that "children at school introduce the disease into the entire home circle down to the youngest infant". Thus much work has been done of late to prove a fact which was observed and proved as far back as 1875.[13)]

The fever hospitals were for the most part of a temporary nature at/

temporary nature at first. In 1879 out of 1593 Sanitary Authorities in England and Wales, 296 had some means of isolating the infected. In many cases only a smallpox hospital existed.

The Public Health Act of 1875, the "Magna Charta of Public Health" had, of course, been the foundation of the fever hospital services, and the development of administrative control of infectious disease, may be said to date from this.

In 1882, in a report to the Local Government Board "On the Use and influence of hospitals for Infectious Disease", Dr. Thorne Thorne advocated:-

(1) Prompt isolation of the sick

and (2) Permanent Hospitals already built and prepared to deal with outbreaks.

Writing in 1855, Farr considered that the spread of disease was due to "minute insects transmitted from one individual to another through the medium of the atmosphere".....as "ingenuously suggested by Dr. Holland in his 'Medical Notes and Reflections', a theory which was supported by Henle of Berlin". 16)

Again he states that "the mere aggregation of people together/

people together in close apartments generates or diffuses the zymotic matter".[16]

Another expression of a modern concept is voiced in the statement that "it is maintained by some pathologists that the same specific poison produces several of these diseases - erysipelas, necusia, and metria"[16] (wound sepsis and puerperal sepsis respectively).

The Infectious Disease Notification Act of 1889, at first adoptive, and made compulsory in 1899, laid down the first group of notifiable infectious diseases, and marked a further stride in the war against epidemics.

The law in regard to the Isolation Hospitals was laid down in the Isolation Hospitals Act of 1893. In 1895, of 1653 extra-Metropolitan Sanitary Authorities, 631 had provided an isolation hospital. By the end of the 19th. century, however, public opinion again turned against the isolation hospital[11] on the grounds that it was "costly and ineffective". This was no doubt due to the fact that the disease admitted was mainly scarlet fever, and as the cases were very numerous, a degree of over-crowding of cases in hospital became more or less/

became more or less the rule.[11] The annual mortality in England and Wales from Scarlet Fever from 1848 to 1855 comprised $\frac{1}{25}$ th. and, in some years, $\frac{1}{20}$ th. of the entire death rate.[16]

With regard to the cost of the hospitals, about 1855 costs of erecting ranged from £164 - £309 per bed. This had arisen to from £350 - £500 per bed in 1901. By 1922, owing to the alteration in living conditions generally after the War, costs were around £750 per bed, and at the present time somewhat above that. Manchester Corporation have decided to erect a 200 bed fever hospital at Wythenshawe in 1937 at a total cost of £200,000.

By the beginning of the 20th. century it was fully realised that the isolation hospital, as a single factor, was not sufficient to stem the epidemic tide. Its usefulness in some cases, however, and as a centre for treatment has lead to the universal erection of hospitals by Local Authorities. The smaller authorities and rural districts have built as well as the larger industrial centres, and so have arisen, on the one hand, the very large city hospitals of three to six hundred beds, and also, on the other hand, the many small twenty to one hundred bed hospitals scattered throughout the County Areas.

The menace from/

The menace from the sea has been guarded against by the erection of the Port Sanitary Authority Hospitals, and legislated for in the Port Sanitary Regulations of 1907, and the Port Sanitary Authorities (Infectious Disease) Regulation of 1920.

By the Ministry of Health Act of 1919, the Local Government Board became the Ministry of Health, and thus the central legislative body for, amongst other things, the Isolation Hospitals. With the foundation of the Ministry of Health Laboratory extra facilities for diagnosis were offered to Local Authorities.

A further great change took place with the passing of the Local Government Act of 1929, by which the functions of each Poor Law Authority were transferred to the County Council or County Borough Councils, and all Poor Law Authorities ceased to exist.

Again, the County Council must.....make a survey of the hospital accommodation.....for the treatment of infectious disease.....and submit a scheme for the approval of the Minister of Health.

The present-day hospitals thus fall into three admininstrative groups/

administrative groups, viz:-

(a) Corporation or City Hospitals under the supervision of the local Medical Officer of Health.

(b) County Hospitals administered by Hospital Committees under the auspices of the County Council M.O.H.

(c) Hospitals of combined authorities under a Joint Hospital Board, and administered directly by a Medical Superintendent.

The degree to which hospitalisation of infectious disease cases has increased is very instructive. The percentage of patients admitted to the hospitals of the former Metropolitan Asylums Board, (now the London County Council), has increased from 33.6 of the total number notified in 1890 to 95.16 for Scarlet Fever and 97.65 for Diphtheria recently.[17)]

Again, whereas it was a question of philanthropic work in the first instance and then the right of only paupers to have treatment, it has now become the right of every one resident in an area and suffering from an infectious disease which is notifiable, to have proper care and treatment for his disease in the local hospital.

The following table of dates and admissions illustrates the progress/

illustrates the progress made in coping with the zymotic diseases:-

DISEASES ADMITTED BY METROPOLITAN ASYLUMS BOARD SINCE ITS INCEPTION (17)

1867	Cases of Scarlet Fever, Enteric, Typhus, Smallpox(Poor Law only till 1883).
1888	Cases of Diphtheria.
1897	Ophthalmia, Ringworm (certain cases)
1910	Measles (Poor Law only)
1911	Measles (Cases other than Poor Law)
1912	Whooping-cough(cases other than Poor Law)
1912 and 1926	Puerperal Cases.
1907	Epidemic Cerebro-spinal Meningitis.
1917	Ophthalmia Neonatorum.
1883	Cholera) When necessary.
1905	Plague)
1919	Trench Fever, Malaria, Dysentery.
1921	Ophthalmia (received through London County Council)
1924	Zymotic Enteritis (certain cases)

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CHAPTER III.

THE MAJOR INFECTIONS

"Leave the chaff, and take the wheat."

EMMERSON. 'The Humblebee'

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SCARLET FEVER:

In 1933 there were 129,528 cases of Scarlet Fever notified in England and Wales, and of these 729 were fatal, giving a mortality of 5.6 per thousand. While the disease remains of a mild character at the present time, it cannot be said to have lessened in its incidence. Indeed, this return represents an increase of more than 50 per cent in incidence over the figure for 1932.[19)]

The death rate from Scarlet Fever has fallen remarkably from 340 per million in 1900 to 46 per million in 1932.[19)] The death rate has varied in extensive waves since the/

since the 18th. century. Between 1796 and 1800 the disease was of a severe character; between 1804 and 1816 it was rather mild but had reverted to its severe form by 1830. The peak of this curve was reached in 1863 when the death rate for children under 15 was 3966 per million. By 1880 the decline in severity of the disease had commenced and has been progressive since then, but more marked from 1900 onwards.[20] Bearing in mind the previous variation in character of the disease, we must realise that it is more than likely that we are at present merely in the trough of a large wave, a circumstance over which the removal of patients to hospital for isolation purposes has had no effect whatever.

There were 38,887 notifications of Scarlet Fever with 310 deaths in Scotland during 1933,[2] so that the high prevalence of the disease exists throughout Great Britain.

There is a severe form of the disease at the moment in Poland and Roumania,[20] but the disease is of a mild character in America, as Pope[21] found that in Providence the death rate had fallen from 110 per 100,000 in 1855 to 4 per 100,000/

4 per 100,000 in 1924. He also finds that 90 per cent of cases are children under 15 years of age, and stresses the importance of the high mortality in later life.

Let us now turn to consider the aetiology of the disease. Chief interest centres round the work of the Ministry of Health Laboratory on the Streptococcus Pyogenes.

Allison and Brown,[19] from swabs of the throats of 100 consecutive cases of Scarlet Fever were able to construct the following table of serological types of streptococcus, and to find that the cases fell, in the main, into one or other of four types, dependent on the power of the organism to produce an erythrogenic toxin.

Strept. Pyogenes		Serological Types Identified.										Unidentified.
Present	Absent.	1	2	3	4	5 Franklin	8 (S.F.4)	11	12	14	27	
94	6	21	27	17	12	3	6	2	2	1	1	5

Of 100 clinically doubtful cases the following result was obtained:-

Strep. Pyog.																	
Present	Absent.	1	2	3	4	5 Franklin	6 283T	8 S.F.4	9 Symons	12 S.F.42.	14 Barker	15 T.S.5	17 S.F.11	22 63T	26 S.F.13.	27 S.F.40.	
61	39	6	5	12	9	1	2	3	1	5	4	1	1	3	1	2	

Thus 39 per cent failed to/

Thus 39 per cent failed to show the presence of the streptococcus pyogenes, and 11 of these were probably pneumococcal. [19] Allison and Brown thereupon put forward a plea for more extensive home isolation on these grounds. Sir George Newman writes that the high prevalence of Scarlet Fever and the continued removal of all cases to hospital has lead to many hospitals being over-crowded, "greatly to the prejudice of both patients and staff". He states, "I have repeatedly referred to the evil effects of over-crowding of fever patients in hospitals and pointed out that not only is the indiscriminate removal of all Scarlet Fever patients unnecessary on medical grounds but it is often unwise".

The work of the Ministry's Laboratory would tend to show that Scarlet Fever is not a definite clinical entity but a response to the toxins produced by one or other of many strains of streptococcus. Griffiths [19] has shown that infection by one strain does not protect a patient against infection by another and that the so-called 'relapse' is, in fact, a fresh infection by a streptococcus differing serologically from that of the primary infection. Todesco [22] recently reported the case of a boy aged 5 who had three attacks of scarlet fever in four months.

Hence, there is/

Hence, there is a grave risk of cross-infection in open wards. Newman calls for special wards for convalescents, adequate spacing of beds, and a short stay of cases in hospital.

With regard to the effect of over-crowding amongst the population in providing cases of Scarlet Fever, Brownlee (Glasgow) in 1917 found a negative correlation, while the London workers found a positive correlation.[20] Riddell[23] found, in a landward area, that over-crowding had no effect on the incidence of cases. Parsons,[1] in an extensive work, finds no connection between over-crowding in the home, and the number of return cases received, and while noting the possible ill effects of over-crowding wards with cases of Scarlet Fever, states that removal to hospital is advisable in most cases at present.

To sum the position up, therefore, Scarlet Fever is occurring in a mild form at present, with a relatively low death rate, but with a distinctly high incidence. The removal of all cases to hospital will result in the exclusion of other diseases, perhaps more severe, owing to the limitation of beds. In addition, there are certain evils/

certain evils attendant upon over-crowding wards with Scarlet Fever cases. Hence, the home-nursing of mild cases where possible should be encouraged, and better provision made for the actual treatment of cases which are removed to hospital, and for the prevention of cross-infection in wards. Removal should be limited to those severe forms of the disease which are not too ill to be moved, those who are normally engaged in handling food-stuffs, (e.g. milk-supply), school susceptibles, those whose home surroundings are unsuitable for treatment to be properly carried out, and those to whom to stay at home would result in loss of employment for the father or other relative.[1)]

With regard to the diagnosis and classification of cases, the Chief Medical Officer of the Ministry of Health, referring to the work of the Ministry's Laboratory states that "a practical application of those figures for hospital administration is that by swabbing all clinically doubtful cases of Scarlet Fever on admission and isolating them till the report of the cultures is received next day, a considerable number could be discharged almost immediately with a/

immediately with a consequent large economy and without danger to the public health." From the epidemiological stand-point, since tonsillitis in one person may give rise to Scarlet Fever in another and vice versa, as well as on clinical ground, there appears to be little justification for treating present day Scarletina in regard to segregation differently from cases of epidemic tonsillitis.

While the foregoing offers great encouragement for the future, it is doubtful whether the typing of streptococci is sufficiently far advanced to be a proposition of practical application in hospitals at present.

Here, then, we have to contend with (1) a new conception of the aetiology of Scarlet Fever, and a review of the type of hospital accommodation required for its adequate treatment, and (2) the difficult question of restriction of numbers of cases admitted. This latter is indeed a difficult question for whereas it is very easy to decide theoretically to restrict admission, in practice it is a different matter attempting to convince a practitioner that his case is not requiring admission to hospital.

A final word/

A final word may be said regarding the question of active immunisation. A revised outlook on aetiology necessitates a survey of the value of active immunisation, and this question will be gone into later when dealing with the staffing and administration of the hospital.

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DIPHTHERIA:

47,435 cases of diphtheria were notified in England and Wales during 1933, with 2646 deaths, giving a mortality rate of 5.5 per cent. This compares with 5.4 per cent in 1932. The disease continues to be of a mild character with occasional cases of marked severity which, at first sight, do not respond to antiserum. Newman suggests that as most cases of the latter type are due to the 'gravis' type of corynebacterium diphtheriae, it is possible that/

is possible that 'gravis' toxin may not be identical with the 'Park 8' toxin from which the antiserum in common use is prepared at present. The differentiation of 'gravis' or virulent and 'mitis' or avirulent types was initiated by Anderson, Happold, McLeod and Thompson (Leeds). Newman goes on to suggest research along the lines of preparing an antitoxic and antibacterial serum.[19]

It has however been, till the present time, accepted that the strains of diphtheria bacilli all have an identical exotoxin neutralisable by one antitoxin(Hartley), and others have suggested the association of streptococci as a cause of the severity of the symptoms in those cases which do not respond to antiserum (Canon 1927).[25]

Several methods of treatment have come into vogue, notably the intensive intra-venous method of antiserum treatment when greatly increased doses of serum, in anything up to 100,000 units are given at one injection. Banks and McCracken[25] recorded a death rate of 2.6 per cent in such cases when treatment by the intensive method was instituted as against a previous rate of 9.3 per cent.

Woodcock, and Benn, Hughes, and Alstead give results of treatment with insulin which show that this has a beneficial effect./

beneficial effect. This is based on the assumption that there is an upset of carbohydrate metabolism in Diphtheria.[25] Peters recently claims that glucose and alkalis given intravenously together with anti-serum in doses of 30,000 - 100,000 units antitoxin will lower the mortality.[26]

Chief interest, however, centres on the value of prophylactic immunisation of children against Diphtheria, and, particularly, the protection of the population aged one to five years, which proceeding is now recognised to be of immense value. The memorandum on the "Production of Artificial Immunity against Diphtheria", issued by the Ministry of Health in 1933 appears to have had considerable effect in stimulating the adoption of immunisation.[19] Immunisation is now practised in one half of the total number of Metropolitan and County Boroughs and in 23 Counties in England and Wales.[19]

Some consternation, however, has arisen recently over the reports of cases of Diphtheria occurring amongst protected members of the population, and it will be opportune here to summarise the recent work on this subject.

Woods (in 1928)/

Woods (in 1928) found that the attack rate amongst nurses at the Little Bromwich Hospital fell from 17.8 per cent before 1922 to 3.7 per cent after 1922 when artificial immunisation of the staff was introduced.

The figures for the Edinburgh City Hospital are: 9.5 per cent from 1919 to 1922, and 3.5 per cent from 1923 to 1925 after the introduction of the method.

Park and Schroder[25] in 1932 recorded that in New York, during 15 years prior to 1931, 500,000 children of school age, and from 1929 onwards, 250,000 children of pre-school age were artificially immunised. Deaths in New York from Diphtheria fell from 880 in 1920 to 416 in 1929 and 198 in 1930.[25]

The criterion of immunity is taken as the negative response to the Schick Test (intradermal). The Schick Test is fully described in any text-book of medicine and need not be gone into here, but what does concern us here is the fact that cases of Diphtheria have been recorded in certain Schick Negative communities, which has sown some mistrust in the minds of users of the method. Let us now analyse some recent figures of workers on the subject.

Underwood reports/

Underwood reports that from 2761 Schick Negative cases in Leeds, 20 cases of Diphtheria were notified. 16 proved to have clinical and "bacteriological" Diphtheria. 13 were given serum in doses of from 8000 to 100,000 units of antitoxin. In 8 cases the blood was examined for immunity level. 5 ought to have been immune, and 2 reasonably so. The inference is that the immunity level necessary to give a Schick Negative reaction is not necessarily sufficient to give a complete immunity to Diphtheria infection.[27)]

Parish and Wright [28)] have shown that outbreaks amongst Schick Negative reactors are mainly due to 'Gravis' and 'Intermediary' types of bacilli. They find that a blood level of $\frac{1}{250}$ to $\frac{1}{500}$ unit of antitoxin per c.c. may give a negative Schick reaction while, in actuality, a level of $\frac{1}{50}$ th. unit is required for complete protection.

They claim, therefore, that the level of immunity will require to be raised.

Park (American Journal of Diseases of Children, xxxii,709, 1926) says "he has never/

says "he has never seen an undoubted case of Diphtheria in a subject with an undoubted Schick Negative reaction".

With regard to the method of immunising, the commonest in use is to give intra-muscular injections of increasing doses of toxoid-antitoxin mixture at weekly intervals after first having tested the subject for sensitivity to toxoid by the intradermal injection of a fraction of the dose (Moloney Test). Alternatively, no Moloney Test is performed but Toxoid-Antitoxin Floccules are used, which give few or no reactions.

Lately there has come into use an alum-precipitated toxoid, which is said to give a more lasting immunity due to its slow rate of absorption from the tissues. An advantage is that it is given in a single injection of half a c.c. dose. The writer has experienced one or two sharp reactions with it but is inclined to the belief that further research will produce a valuable immunising agent along these lines.

From the foregoing facts certain deductions can be drawn. In the first place, there would appear to be an obvious reason why the Schick Test has been unreliable in some/

in some instances. If, acting on the principle of a required rise in the immunity level, we give stronger immunising doses of toxoid-antitoxin mixture, or more powerful agents, e.g. alum-precipitated toxoid, and so ensure a completely immune population, we should have a very effective means of cutting down the incidence of Diphtheria.

Thus the removal of cases to hospital then becomes a question of the treatment of the case solely.

From this point we come to the recent work of Dudley, May and O'Flynn.[29)]

Having given certain factors which go to prove the value of the Schick Test, and having discussed the question of 'latent immunity' as already described here, they proceed to make the following declaration:-

"The rapid transference of Schick susceptibles into Schick immunes, by artificial immunisation, should augment the carrier rate for virulent diphtheria bacilli, and should increase diphtheria morbidity amongst the unprotected members of the herd."

This would appear/

This would appear to be a reasonable assumption, but Stallybrass[41] has pointed out that there ~~is~~ are insufficient grounds for the assertion and that American workers have found that directly 30 per cent of the pre-school children had been immunised, Diphtheria practically disappeared. (E.S. Godfrey).

At any rate, one point of supreme importance does emerge. Since the numbers of cases should diminish, there ought not to be the same need for provision of large numbers of beds for Diphtheria cases in hospital, and also that, since most cases will be admitted primarily for treatment, the wards must be suitably equipped for adequate treatment to be given to the severest cases.

Lastly, there is the question of the admission of carriers to hospital. This, in view of the foregoing, would appear to serve no useful purpose, and, if the immunisation of pre-school children becomes a universal practice, will be given up entirely.

The present difficulties under this heading will be discussed in the chapter dealing with administration.

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MEASLES:

Although the death rate from Measles has declined from 2673 per million between 1911 and 1914, to 990 per million between 1926 and 1932, there is still a large mortality and great deal of disablement due to this disease. There were 1948 deaths from Measles in England and Wales in 1933. Since Measles is not universally notifiable, it is impossible to compute the annual incidence of the disease, but Newman[19] assesses the number as 50,000 in each biennial London outbreak.[19]

In the Annual Report for the year 1933, of the Department of Health for Scotland, on the other hand, we read that "most noteworthy is the comparative freedom of the country from Measles. Not only were the 36 deaths from that disease the lowest number ever recorded, but the previous lowest figure, that for 1929, was 149, four times as great".

Measles being of a highly infectious nature might prove to be a great source of danger to life at any time. Also it leaves its trail of disablement owing to the frequent occurrence/

frequent occurrence of complications, notably broncho-pneumonia. The heaviest mortality occurs at ages between six months and two years, but any age may be attacked if there has not been any previous exposure to Measles. Brownlee[30] cites the case of an epidemic of Measles occurring in a Highland Glen where Measles had been absent for 80 years. The disease swept over all the inhabitants, (including an old woman of eighty years of age), without a single death. Brownlee proceeds to state that "Measles is not open to administrative control in the sense that control means prevention". In general, the younger children in the home are infected by those going to school, a fact noted by Thomas in 1875,[13] and emphasised by Picken (1920)[31] and Halliday (1928).[32] Brownlee, discussing the question of early diagnosis, stresses the question of rise in temperature and oedema of the conjunctiva. Looking for Koplik's spots, is in most cases, in his opinion, a mere vanity. Cases which die in the first few days do so, he states, from a "suffocative catarrh", as distinct from broncho-pneumonia.

Picken,[31] in a survey of epidemics of Measles in (a) a rural and (b) a residential area in Scotland, puts forward a/

puts forward a plea in favour of notification, and preventive measures. The fatality, he finds, falls as the density of the population diminishes. 34.6 per cent of his primary cases occur in children under the age of 5 years. He finds school closure effective in rural areas in controlling the spread. One half of the cases are infected outside their homes, and two thirds of the cases are in children of school age.

Halliday[32] found a very high incidence in certain working-class tenement buildings. Taking 120 children under 10 years of age, who had not had the disease, under observation, he found that in nine months 64 took Measles. 53 of these were below school age. Infection was introduced "by a scholar, removed to the hospital on the day following the rash appearing, who infected 7 children under school age, and possibly another scholar. In all, 6 families were infected from the one case." In the tenements examined, the incidence rate of Measles was 3.7 times greater among children below school age than among scholars of ages 5 to 10 years.

Charles[3] in 1934, again stresses the high incidence of Measles amongst working-class families in over-crowded areas, particularly amongst/

particularly amongst those living in tenements.

Gunn[33], 1935, in an article on the home treatment of Measles, points out that, owing to the infectivity being greatest in the pre-eruptive stage, we "cannot control the epidemic by isolation" of the patient.

The question of convalescent or adult serum for contacts, as a prophylactic measure, is of the utmost importance, and sufficient work has been done now to satisfy one as to its efficacy.[25]

Harries[34] finds that serum from adults is easier to get but is less effective than serum from convalescents. The serum must be Wassermann-tested, and the history of the donor must be clear. The sera from various donors can then be pooled. Doses of 3.5 to 5 ccs. are given about the fourth day after exposure, so as to allow a modified attack of measles, and hence the development of an active immunity. Harries finds 25 to 50 ccs. necessary for full protection. The doses are given intramuscularly.

From the foregoing data, let us now draw a few conclusions as to the position of Measles with regard to hospital control./

hospital control.

There is a high positive correlation between Measles incidence and over-crowding, particularly in tenements, in the poorer areas in the towns.[3] Where the Measles rate is high, the Pneumonia death rate is high.[32] For reasons already stated, removal of the primary case will not stop the spread of the epidemic, except, perhaps, in isolated rural outbreaks. The high complication rate amongst poorly nourished children, demands the provision of proper hospital accommodation for complicated cases, and cases whose home surroundings prohibit proper care and attention. Few hospitals in the provinces make provision for the admission of cases of Measles. Housing conditions play a prominent part in the spread of Measles, and Halliday[32], comparing the death rate from Measles in Glasgow and Birmingham, where tenement systems are fewer, found that the death rate for the age groups under 2 years, is three times higher in Glasgow than in Birmingham, and for the age group 2 - 5 years, is twice as high.

Again, there is/

Again, there is the question of control of the epidemic by serum, and the advocacy for centres throughout the country for the control of supplies. London has now four such centres, at the four group laboratories, which each receive contributions of serum from the hospitals in their respective areas. The hospitals can then call on supplies of serum when required. The serum is put up in 5.c.c. ampoules. Two such centres were established in Paris in 1925 at the instance of the Academy of Medicine. At one - the Children's Hospital - 10 litres of serum representing 2000 protective doses were collected in the first five months, and proved adequate in amount for their purposes.[35)]

Thus we shall have to consider:-

(a) the question of proper accommodation for complicated Measles cases

and

(b) the question of adequate supplies of protective serum.

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WHOOPING-COUGH and PNEUMONIA:

In 1933, in England and Wales, there were 2270 deaths from Whooping-cough, only 19 of which occurred in cases aged 15 years or over. The proportion for all ages is 4 per 1000 cases. Newman [19] writes that of the common infectious diseases of childhood, measles and whooping-cough now occupy the most prominent places, while the largest contributor to the death rate at 1 - 5 years is Pneumonia. There is no great fall of recent years in the mortality due to broncho-pneumonia. Broncho-pneumonia is a frequent complication of Whooping-Cough.

Of 10,953 known cases of Whooping-cough occurring in Scotland in 1933, there were 762 deaths. [2]

This question of high complication rate and mortality raises Whooping-cough to a level with Measles in its demands for admission to hospital for proper nursing. Again, as in the case of Measles, removal to hospital of the primary cases will not control the epidemic and manifestly all cases cannot/

all cases cannot be removed to hospital. Housing conditions play a large part, and over-crowding is a great danger, but one cannot look to the future for a betterment in results so far as housing is concerned, for Smith [32] found that in re-housing areas chill and sore throat were less frequent and bronchial catarrh and pneumonia more frequent than in poorer areas. This was due to the fact that the rehousing area under consideration contained 60 per cent more children under 5 years of age.

Over-crowding in sleeping accommodation was as common as in the slums. Smith assesses the incidence of respiratory disease as 601 per 1000, an alarmingly high figure. The chief difficulty with regard to the diagnosis of Whooping-cough is the long incubation period. Benson [36] suggests a method of holding Petri plates with a blood-agar medium in front of the coughing child and bacteriological examination of the surface of the plate after suitable incubation.

Vaccines have been used extensively in the treatment of Whooping-cough. The results in so far as treatment is concerned are very variable [25], and Cockshut suggests/

Cookshut suggests that the reason is because doses are too small. He has given vaccines in doses 4 to 10 times greater than those in common use with good results. Kaupe stresses the need for giving the vaccine in the early stages, and points out that it has a definite value for contacts in preventing the spread of the disease [25]. (The common dosage is B.Pertussis 500 millions, B. Influenzae 250 millions, Pneumococcus 20-100 millions per c.c. and 0.2 to 1 c.c. of this is given every day or every second day to children aged 5 or 6 years)[25].

Statistics with regard to Whooping-cough incidence are meagre, but the disease is regarded as having its highest mortality in the first year of life (Neusholme - Statistics p.182). Russell (Glasgow) found at Belvidere Hospital in 1892 that of 266 cases admitted there were 23.5 per cent deaths, of cases from poor homes mostly.

At the present time, however, we must admit that the Whooping-cough mortality is only one quarter of what it was in the years 1861 - 70.

With regard to Pneumonia, Newman finds that the mortality in County Boroughs is double that in Rural Areas. The largest contributor/

The largest contributor to the death rates in ages 1 - 5 years is Pneumonia. Here, again, rises the question of over-crowding. The total number of deaths in England and Wales from acute primary pneumonia in 1933 was 30,059.

Recent work on the aetiology of Pneumonia goes to emphasise the infectivity of the disease [42]. The fact that swabs of the throats of contacts show the presence of the same type of organism and the possibility of typing the causal organism, open up two further questions.

The first is the question of removal of Pneumonia cases to a fever hospital, instead of to a general hospital, and the second is the question of the use of a therapeutic antiserum (e.g. Felton's).

It is, however, generally accepted that after the third day of the disease there is a grave risk in removing patients to hospital, and in these cases the patient is best nursed at home.

The question of the nursing of cases of Pneumonia in isolation hospital will be taken up later.

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INFLUENZA:

The wide incidence of Influenza serves to show how impossible it would be to prevent an epidemic by isolation of cases in hospital. The highest weekly number of deaths from this disease was 115 in 1933, as compared with 1,934 in the previous winter, in the 118 Great Towns in England and Wales.[19)]

There is, however, a heavy mortality from acute Influenzal Pneumonia, and, since the treatment at present resolves itself into good nursing, perhaps in certain cases where home surroundings are unsuitable, early removal to hospital would result in a saving of life.[19)]

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OTHER INFECTIONS:/

OTHER INFECTIONS:

While the remaining infective conditions are lessening in incidence, and some are only occasionally met with, at the same time, they are potential sources of danger to the general public, and provision in hospital should be made for the receiving of a variety of conditions, which are only occasionally seen, for two reasons:-

(1) because they are unsuitable for treatment at home or in general hospitals,

and

(2) because, in some instances, removal of the first cases will do something to check the spread of the disease.

The first in importance are the infectious conditions involving the central nervous system.

In 1933, in England and Wales, there were 1695 cases of cerebro-spinal fever notified, with 942 deaths. The general incidence has been above normal since 1930 but appears to be declining again. It is important to note that since typing of the organism, and serum treatment is of paramount importance, hospital is the only proper place for/

proper place for such to be carried out.

The incidence and deaths from poliomyelitis and polioencephalitis have remained and in ten years have not varied much, except for a sharp rise in 1926 and a drop in 1931. There were 714 cases reported with 135 deaths for Poliomyelitis, and 83 cases with 67 deaths for Polioencephalitis in 1933 (England and Wales).

There has been a steady decline in deaths and notification from encephalitis lethargica in the past ten years, being 815 and 432 respectively in 1933 as compared with 1407 and 5039 in 1924. (England and Wales).

The excess of deaths over cases represents a proportion of cases not notified during life, and some notified in previous years and dying after an interval of chronicity.[19)]

It has been shown that before the outbreak of epidemic cerebro-spinal fever occurs, the carrier rate may be as high as 20 per cent of the population. Hence, it is impossible to prevent the epidemic by isolating cases as they occur. Proper spacing of the members of schools or barracks where outbreaks have occurred, and especially proper/

especially proper spacing at night time in sleeping accommodation, has been sufficient to cut down the spread. Swabbing of close contacts is useful, but general swabbing is impracticable, as also is hospitalisation of contacts or carriers. An abundance of fresh air and sunlight and the avoidance of droplet infection are criteria to be aimed at. Also over-crowding in sleeping quarters, particularly in cold weather, is to be avoided.[38)]

Smallpox cases numbered 631 in 1933 in England and Wales. This disease remains of a mild type, and occurs only in unvaccinated children and in vaccinated adolescents whose immunity has expired due to the length of time elapsing since the date of the vaccination. There were 7 cases of post-vaccinal encephalitis, one of which proved fatal in 1933.

Typhoid Fever is met with only in isolated instances. Outbreaks are few. In October 1933 at Kidderminster, there was an outbreak with 9 cases. Again, in October 1933, there were 22 cases of Paratyphoid Fever at Epping as a result of infection of the milk supply.[19)] Modern sanitation and improvements in preparation of food supplies should maintain/

should maintain comparative freedom from the enteric group of diseases, particularly if the source of infection is speedily traced, although, in many instances, this proves impossible.

Dysentery (bacillary) occurs occasionally but only in areas where it would appear to be endemic, notably Newcastle-on-Tyne, and in mental hospitals. There were 783 cases in 1933. Such cases are always better removed to hospital, although the writer was forced to treat several cases at home in some over-crowded areas of Tyneside, owing to shortage of hospital accommodation, without, however, any spread of disease occurring.

There were 2 cases of Psittacosis in England and Wales in 1933, one case of Malaria notified as having arisen in this country, 217 cases imported, an isolated outbreak of epidemic Myalgia in Yorkshire [40], and sporadic cases of Anthrax.

The last cases of Typhus Fever occurred in 1929 in Scotland. These were two in number and were dock labourers engaged in unloading cargo from Cuba. There are still a few cases in the Irish Free State.[19]

Rigid Port/

Rigid Port Sanitary administration, and notifications of cases will suffice to prevent the spread of all the mentioned diseases.

There were 1191 deaths from Erysipelas in England and Wales during 1933. This disease is, in the main, admitted to isolation hospitals. In connection with this Banks[24] stresses the value of ultra-violet ray therapy and anti-streptococcal sera.

Ophthalmia Neonatorum, owing to its infective nature, is generally admitted to fever hospital.

Then there is the important question of the suitability of treating cases of Puerperal Sepsis in isolation hospital as opposed to the wards of a maternity hospital. This important point will be discussed in the chapter on ward construction.

Finally, we shall have to consider the suitability of treating Pulmonary Tuberculosis in a unit within the confines of the isolation hospital walls.

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GENERAL CONCLUSIONS/

GENERAL CONCLUSIONS

From the foregoing remarks on the present incidence, and relative importance of the infectious diseases, let us now formulate a few conclusions, in so far as such will affect the consideration of the requirements of the modern isolation hospital.

In the first place, most of the larger hospitals now make provision for the reception of a more varied number of diseases, and for reasons already given this is a practice to be encouraged.

Again, pride of place from the point of view of mortality should be given to respiratory infections, notably Measles, Whooping-cough, and Pneumonia, and hospitals must be suitably constructed for the reception of these diseases.

We are faced with a new conception of the aetiology of Scarlet Fever, and so-called "relapses" may in actual fact, be re-infection, and hence, occurring in hospital, really cross-infection. Hence, a review of the accommodation afforded to/

afforded to Scarlet Fever cases is desirable. Most cases of Scarlet Fever are at present of a mild type and more should be done to encourage home isolation and discourage over-crowding of the hospitals with cases of Scarlet Fever.

Fewer beds are being required, and should continue to be required for Diphtheria cases, which is for the most part mild in nature with occasional severe cases.

As the population increases the risk of respiratory infection amongst the younger members increases, and modern housing schemes have not, in practice, materially reduced the incidence. (Halliday)[32]

Again, transport has speeded up and the passage of infection through the medium of carriers occurs more speedily in consequence.

The isolation of patients in hospital will not prevent the occurrence of epidemics, hence the hospitals will exist for the treatment, primarily of infectious disease. Therefore the wards must be so constructed and administered as to afford efficient nursing for a variety of conditions and a minimum of risk of cross-infection. This leads on/

This leads on to considerations of construction and staffing arrangements. From this point onwards the literature is very deficient in references, and the only possible way to evaluate hospital practice is to visit various hospitals, large and small, and study conditions first hand.

The chapters to follow will be devoted to this study, after which the hospital policy will be traced, and any desirable changes summarised.

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CHAPTER IV.

THE CONSTRUCTIONAL REQUIREMENTS of the ISOLATION HOSPITAL

"In wall and roof and pavement scattered are
Full many a pearl, full many a costly stone."

ARIOSTO.

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In order to gain a personal insight into existing conditions, the writer visited a number of representative hospitals throughout Scotland and England. Mention will be made of these hospitals in the following discussion. Where a hospital has not been visited by the writer personally, reference will be given to the source of information.

It must be borne in mind that many of the large and most useful city hospitals are amongst the oldest in the country. Everywhere one found that reconstuctions were being/

were being carried out to suit existing buildings to present-day theories. Hence, while one has formed some definite opinions on the construction of the ideal type of hospital, it must be admitted that with a moderate expenditure many existing hospitals could be made entirely suitable.

It has been found convenient to deal separately with several items which have been headed accordingly.

THE HOSPITAL SITE:

In general, the site chosen chould be a healthy open one, on a dry sandy soil with a gentle south-east slope, and at a moderate elevation. The site is chosen, apart from these points, with a view to economy and utility. Much depends, therefore, on the area which is served. While most medical men will agree that the hospital should be situated fairly close, say two miles, to the town served, it must be admitted that the earlier city hospitals, now entirely surrounded by houses, were built with this in view, and with the rapid spread of modern housing schemes a new hospital will almost inevitably soon have houses adjoining it. Judicious town planning/

Judicious town planning must ensure adequate spacing around, although the risk of wind-borne infection to neighbouring buildings can be discountenanced.

Where rural areas are served, a site some four or five miles from the more populous parts will be found advantageous.

A good water supply is essential. The fall of drainage must be considered, and the avoidance of smoke and acid fumes from neighbouring works is important.

Waste waters drain into public sewers, a proceeding which is not dangerous to the public health. Excreta etc., are disinfected in the hospital prior to entering the drains, and the methods of sewage purification in use are sufficient to ensure limits of safety.

Parsons [11] cites a few situations which are to be avoided, such as those near tips, abbatoirs, and piggeries, as being breeding places for flies. He further states that sites close to destructors (as at Acton), cemeteries (Wimbledon and Middlesborough), sewage farms (Croydon, Ealing and Brentford), while not ideal, are not really disadvantageous. A site close to a railway is a/

railway is a drawback. One can accustom oneself to the noises of shunting trains in course of time, but patients are mostly acutely ill for the first few days after admission, during which period they are not so accustomed.

THE SIZE OF THE HOSPITAL:

A multiplicity of small 20 - 100 bed hospitals, as is found at present in several county areas, is uneconomical on account of staffing and equipment. Smaller rural and urban districts should combine for the purpose of Isolation Hospital services, and hospitals of anything from two to five hundred beds aimed at. This is at present being done in the administrative County of Northumberland. With telephonic communications and motor-ambulance transport, distances of anything up to thirty miles can be covered without detriment to the patients, in the main. One might make exception to this statement in the case of Pneumonia after the third day of illness, and very ill typhoid or diphtheria cases; but here the judgement of the local doctor must be exercised as to the advisability of removal.

On the other hand/

On the other hand, a hospital can be inconveniently large. A hospital of more than 500 beds can not be administered comfortably, and, thus, in the larger cities, it is found necessary to duplicate hospitals, as at Glasgow, London, Leeds, Liverpool and Birmingham. There is a great advantage in this for dealing with epidemics. Schemes in use at Liverpool and London will be discussed in later pages under administration.

The area of the site will depend on local requirements. Not more than 20 beds should be allowed per acre.[11] An important detail here is that sufficient space should be allowed for extensions, and at the new Coventry Hospital a present 148 beds can be extended to 232 beds if need be in the future.[39]

The New Hall Infectios Diseases Hospital at Southport, opened in October 1927 has 10 beds per acre, and that at Hendon 8.6 beds per acre.[39]

It is generally accepted that one bed per 1000 of population served is sufficient. In the past, emergency accommodation in the shape of huts and tents have been used in times of epidemics. These, however, are never satisfactory and/

never satisfactory and permanent buildings should be aimed at, giving sufficient accommodation for the needs of an area as estimated over a number of years. McMichael [43] gives 2 beds per 1000 as the ideal in a paper on planning a new hospital of 150 beds at Paisley. The Southport Hospital allows one bed per 1128 of population, Hendon one bed per 1344, and Coventry one bed per 1100. The question of beds is one primarily of expense and depends on how far the Infectious Diseases Hospital is capable of saving life, or otherwise justifying its existence in the war against epidemics.

THE COST OF ERECTION:

When one comes to deal with the cost of erection of the hospital, several items must be borne in mind, viz preliminary expenses in formation of the hospital district, the cost of the site and expenses of local enquiries, the cost of the actual buildings, the cost of furnishing, permanent extensions, drainage works, and structural repairs.

McMichael gives the cost as £666 per bed for building costs which for a/

which for a population of 78,000 means an increase of 2⅝d. on the rates, on a 30 years loan.[43] The Southport Hospital cost £794 per bed, and Coventry £723 per bed. These figures exclude the cost of site and equipment.[39]

The new Markfield Hospital at Leicester had an "all-in" cost of £611 per bed.

It has been decided to build a new Manchester Hospital at Wythenshawe in 1937 at an "all-in" cost of £1000 per bed.

There are, therefore, wide variations in the building costs dependent on local conditions.

The report of the Committee on Local Expenditure published in 1932 contains in paragraph 183 a recommendation with reference to hospitals "that there should be an immediate enquiry by a competent committee into building costs with a view to arriving at standards which will provide without extravagance the essentials for the treatment of disease and take account of modern methods of construction". This committee was appointed in 1933 and is still sitting.[19]

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THE GENERAL PLAN OF THE HOSPITAL

Before considering in detail the various units, let us sketch roughly the general plan followed by most hospital authorities.

Unlike a general hospital, for purposes of isolation, the wards and other units consist of separate buildings which may or may not be linked up by covered passage-ways.

The administrative buildings are found to the northern side of the hospital, and facing north or north-east. This block comprises the main offices, and medical and nursing-staff accommodation, with the kitchen offices behind. This makes a very neat, compact unit, good examples of which are to be seen at Fazakerley Hospital, Liverpool and at the Florence Nightingale Hospital, Bury. There are certain drawbacks to this plan, however, and in the newer hospitals, for reasons to be described, one finds the nursing-staff housed separately, as at the Knightswood Hospital, Glasgow.

A new block for the nursing and domestic staffs has been/

has been erected within the past three years at the Walkergate Hospital, Newcastle-on-Tyne.

The wards lie behind the administrative block, that is to say, south of it, and should, in order to get as much exposure to sunlight as possible, run in parallel rows with the long axis of the ward running in a north-east to south-westerly direction.

This is a modern development. One finds the wards of the older hospitals running due north and south.

To one side of the hospital, conveniently the north-west, will be found a separate unit comprising the boilerhouse and laundry, with, offset from this, the mortuary and ambulance sheds. Separately, but not adhering to any definite plan will be found the admission and discharge blocks, pathological laboratories, X-ray room, lecture rooms and operating theatres.

The hospital is surrounded by a brick wall (6 to 8 ft. high) and has two entrances at least. One leads through to the administrative block and has a porter's lodge at the gateway. The other leads to the mortuary, boilerhouse, laundry and ambulance sheds, etc.

The buildings are/

The buildings are situated at a distance of not less than 40 feet from the boundary wall, a similar space separating each ward unit.

The various buildings will now be discussed in detail under the appropriate heading.

THE ADMINISTRATIVE BLOCK:

It is found convenient to have the main offices together with the quarters of the matron, and of the medical staff. In estimating the size of the building one should bear in mind the possibility of future extensions. In the larger hospitals one resident medical officer is employed per 100 beds, but it is wise to provide an extra room in case extra help is required in epidemic times. Thus, at the new Markfield Hospital, Leicester, the work has been so heavy that an extra medico has been employed during the past winter.

An office will be required for the Medical Superintendent, and one for the Matron.

McMichael [43] suggests a waiting room for travellers and one for relatives and friends. Several small rooms have been set/

have been set aside for this purpose at Belvidere Hospital, Glasgow. McMichael mentions also a telephone office. In general the outside exchange telephone is best fitted up in the main office, as at Newcastle-on-Tyne, and Liverpool, with a switch through to a receiver in the hall for such times as the office is closed. In this main office are shelves for the hospital records, and filing cabinets for current patients.

A board-room must also be provided, and a doctor's sitting-room and dining-room. Above the fore-going are the bedrooms of the medical staff and nursing staff in many hospitals, but the latter are better housed in a building apart.

Behind the administrative block are the kitchen offices, comprising the kitchen, pantries, general stores, and linen stores. A most important item is the provision of a refrigerating plant. An excellent example is in use at Bury, and is set working by an automatic electric device at certain hours of the day. The kitchen offices should be centrally placed with regard to the wards, as this situation is most convenient. The rooms can/

The rooms can be set off a central passage running at right angles to the axis of the administrative block, as at Fazakerley Hospital, Liverpool. Here, for convenience, should be the dining-rooms for the nursing and domestic staffs.

Dietetics should rightly be accorded an important place in the hospital routine. The modern kitchen is the epitome of cleanliness and efficiency. To this end, the kitchen is best built in a single storey, the central portion of the roof being of glass to afford a maximum of natural lighting.

The kitchen is large and well ventilated. Fumes and dirt should be minimised by the use of electric ovens.

Such things as potato-mixers, bread and meat-slicing machines save time and labour, and, what is equally important, produce food which, in appearance, is much more acceptable to lessened appetites.

In order that they may be quickly and easily cleaned, floors should be made of cement or terrazzo and the walls should be tiled to a height of 5 feet. It is obviously time-saving and convenient to have the pantries, and store-rooms lead off from the kitchen.

NURSES' HOME/

NURSES' HOME:

The nursing-staff should be housed separately in a Nurses' Home. Particularly where there is a large staff, the accommodation can not be conveniently produced in the administrative block. Also, a certain amount of privacy is welcomed by the staff, away from the scene of the daily routine. The new block at Newcastle provides for both nurses and domestics; but a much better plan is that at Belvidere, Glasgow, where a separate block is provided for the maids.

There should be provided a Sisters' Room, Nurses' Sitting Room, Maids' Sitting Room, and recreation rooms for Nurses and Maids. A welcome addition would be a library-study room for nurses. Facilities for both study and recreation are painfully lacking in many of the smaller or older hospitals.

The provision of tennis-courts, putting-green, and swimming-pool are modern tendencies and have been provided at Markfield Hospital, Leicester.

Modern hospitals provide to a greater extent for the teaching of the nursing-staff. A Lecture room cum laboratory can be incorporated in the Nurses' Home. Facilities and equipment are necessary for the adequate tuition of nurses in/

of nurses in cookery and practical nursing.

With regard to the extent of accommodation required, 100 sq. feet of floor space may be allowed for Nurses' and Maids' Rooms, with 120 sq. feet for Sisters' Rooms.

An important item is the provision of quarters in a quiet part of the building for the Night Staff. At the Edinburgh City Hospital the Night Staff are housed above the nurses' Sick Ward which is set above one of the ordinary hospital wards.

Much space can be saved in rooms by having wardrobes built into the walls, as at Knightswood, Glasgow, and at Newcastle. This also effects a saving in furniture.

For sanitary arrangements, a fair estimate is one bathroom and one water-closet to every ten of staff, while one lavatory basin should be provided for every four of staff.[43)]

Another item which is often over-looked is the provision of a small hall for staff dances and social functions. This may also be used as a recreation room for the nurses, as at Belvidere Hospital, Glasgow. At the Markfield Hospital/

the Markfield Hospital, a large hall-dining room is provided, with a platform at one end, and a Cinema projecting room at the other; but this has been erected because of the Sanatorium portion of the hospital. The tuberculous patients dine in the hall and have their entertainments there, while the hall can also be used for other functions. From this hall music can be relayed to the various wards. This elaborate building is justifiable only if the hospital is also to be used as a sanatorium.

THE WARDS:

In the older hospitals wards were erected either as single-storey pavilions, or double-storey blocks, with a uniformity of plan, which is totally unsuitable for the admission of a large variety of diseases.

In the first place, a large number of cases admitted will be doubtful cases for observation, a certain number will be contacts with diseases other than that from which the patient is suffering, a further number of cases of double infection and others wrongly notified, and so on. The risk of cross-infection is grave both to the patients already in wards, and to those coming in, if they happen to be observation/

to be observation cases, unless one has adeqauate means of isolating individual cases. Hence, the modern hospital provides various types of accommodation for these various purposes.

One finds:-

(1) Large pavilion or double-storey wards for accommodating cases of one disease only.

(2) Similar general wards for the admission of a variety of diseases which can be nursed side by side "in barrier" as will be described later.

(3) Cubicle wards for observation cases, cases of double-infection, etc.

Firstly, points in connection with ward construction and equipment in general will be dealt with, and thereafter will be discussed the most suitable accommodation for the various types of disease, barrier-nursing, and cubicle blocks.

Finally, in this section, one will deal with the extent of accommodation which should be provided for the various diseases. (See "Administration").

At about all of the hospitals visited, the view was expressed that the single-storey pavilion type of ward was most suitable for cases all of the same disease, and this type of/

this type of ward is to be seen at most hospitals. At some of the city hospitals, however, owing to the lack of ground space, double-storey buildings are in use. There is no definite plan adhered to, however, and hospitals differ widely in this respect.

The Manchester City Hospital is built solely on the single-storey plan, while the Salford and Rochdale Hospitals are built entirely on the double-storey principle. Edinburgh City Hospital consists almost entirely of two-storey buildings.

It cannot be said that the hospitals of the future will have either only one or other type, as both Glasgow and London are purposing erecting double-storey as well as single-storey buildings. There is a place in the hospital for both types of building, as will be discussed later.

Wards should consist of permanent buildings of brick or stone.

The single-storey ward forms a unit in itself, and provides accommodation for males and females. The type of ward in general use has been modelled after the plan suggested by the Local Government Board in 1892.[44] There is a ward to hold a dozen or more beds, on either side of a/

side of a central vestibule. The nurses' duty room is situated in the centre of the pavilion, and has small observation windows looking into each ward. The sanitary annexes are situated at the ends of the pavilion.

Now, there are many drawbacks to this older type of ward unit, and alterations have been found in the newer pavilion wards. It is intended here to point out the most useful alterations which have been made and to stress defects which can be remedied. In this way, criticism is intended to be entirely constructive.

The chief drawback is that no proper means of preventing cross-infection in the ward is provided.

It has been acknowledged by most writers that many cases, such as septic scarlets, whooping-cough, etc., do very well in an open-air environment. [11) 24) 43)] In the older wards, and especially the double-storey wards, no means of achieving this is available. The modern tendency, therefore, is to build verandahs along one or both sides of the ward, opened on from the ward through double swing-doors. Alternatively, as at Fazakerley Hospital, Liverpool,/

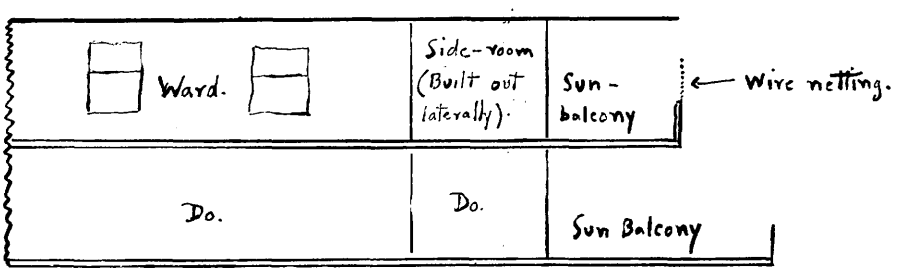
Fazakerley Hospital, Liverpool, the beds are run down on a slope from the double doors on to a grass border. This causes the staff a great deal of trouble and is not possible in inclement weather.

Again, an absolutely open verandah, as at Bury, can only be used in dry weather, and there is always a certain risk to the staff through exposure after having worked in the ward.

The best arrangement is a covered-in verandah facing south-east, with double glass windows all along its front, as is in use at Monsall Hospital, Manchester. This type of verandah is, of course, costly, but can be heated, and cases can be treated on it day and night independent of weather conditions. It also increases the ward accommodation and is a protection to the staff in inclement weather.

The position of the sanitary annexe at the extreme end of the ward is open to question. This entails a good deal of walking on the part of the nurse after handling each case. An annexe situated about midway along one side of a ward is a greater convenience. The ward end is then/

ward end is then left free to be used as a sun balcony or solarium for convalescent patients. This is a real benefit in cases where a verandah has not been provided and many of the older double-storey wards could be reconstructed to make use of the end of the ward. A good arrangement is seen at Edinburgh City Hospital, where the wards run North and South, the south end being reconstructed to allow of sun balconies. The upper storey balcony is set back on the lower to allow of adequate sunshine to each, while a wire netting arranged on the upper edge affords privacy to those on the lower balcony. The following elevation illustrates this point:-

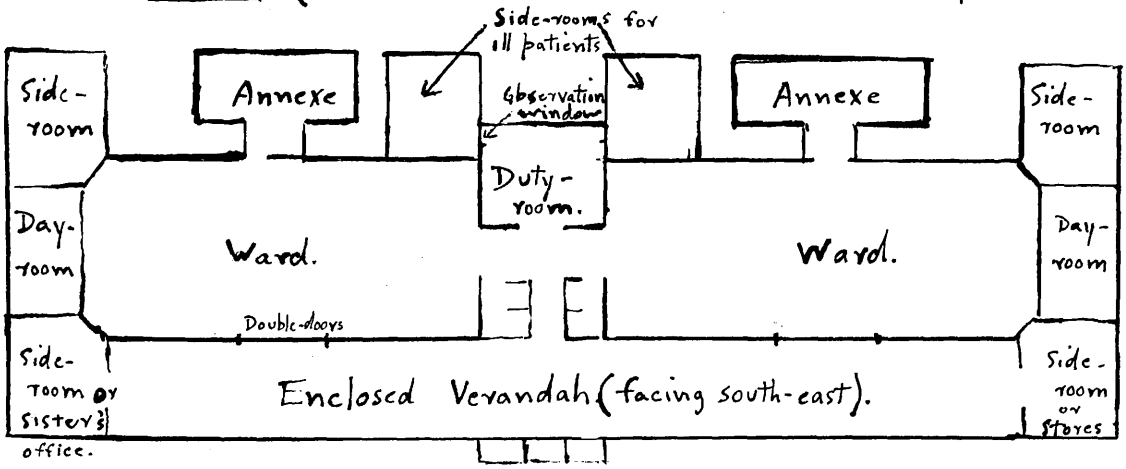


A further defect in many wards is the lack of side-room accommodation. Although observation wards are provided separately, many cases develop complications or show symptoms suspicious of second diseases, which necessitate temporary isolation.

The following plan/

The following plan is suggested by the writer for pavilion wards.

Plan A. (Diagrammatic) To illustrate essentials of lay-out.



In many cases, as at Bury, the side-rooms are provided with separate W.C. and lavatory accommodation. One ward is reserved for males, the other for females. As many more children than adults are admitted, the plan at Salford City Hospital is to use a double-storey block for one disease, with males on one flat and females on the other. The wards on the one floor are not then made equal in size. One ward is rather larger than the usual length of ward and accommodates 40 beds for children; while, on the other side of the duty-room, is a small ward for 10 beds for adults.

Besides the duty-room, a small office for the Sister in charge should be/

should be provided. The remaining necessities are store-rooms for ward equipment and linen.

It was early realised (McNeill [44]) that ward walls should be of a smooth, easily washed, material. Hobday[39] in dealing with modern tendencies, stresses the value of deadening sound in the ward. He mentions an 'acoustic plaster' which, however, is rough and unwashable. Gypsum is used in U.S.A. and Canada, and cleaned with a vacuum cleaner. Again, it cannot be washed or decorated. This point of deadening sound, is, in the writer's opinion, greatly over-stressed and the undecorated walls must afford a monotony of outlook only equalled by the accompanying silence.

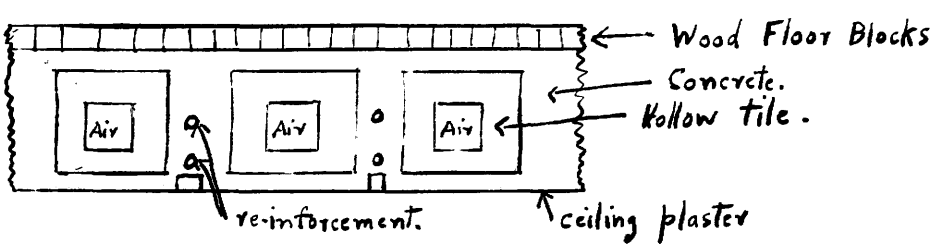
Hobday further points out the value of brighter wall colours to the ill person, and suggests walls of "sunshine colours - a primrose yellow shading to a cowslip yellow, or strippling or scrumbling with occasional black squares, etc." An inovation is the spraying of walls with quick-drying cellulose paint by compressed air. A large ward can be sprayed in 48 hours. This gives a beautiful finish, and can easily be kept clean.

Many novel ideas/

Many novel ideas can be developed in the Children's Wards, as at Bradford City Hospital. Pictures on the walls depict animals and scenes from fables. A general air of brightness should stimulate the child to a speedier recovery.

Ward floors should be easily cleaned and durable, with a certain degree of elasticity. In most hospitals reliance is placed on a floor of hard wood blocks, such as teak.

The first floor of the new pavilion at Aitken Sanatorium, BURY, consists of hollow tiles set in re-enforced concrete, on which the wood blocks are laid. The tiles act as non-conductors of both heat and sound. The following section will illustrate this:-



A bad type of floor is concrete covered with linoleum. To this, the blistered feet of the nursing staff bear/

staff bear testimony.

Various composition floors are in use, (Ladywell Hospital, Salford). A composition floor wears well, is not too hard on the feet, and is easily kept clean; but may provide a dangerously smooth walking surface.

In the production of elasticity and the deadening of sound, much is to be said for rubber floors, and floors of compressed cork.[39] A drawback to those is the fact that stains can not be wiped away completely. At Aitken Sanatorium, Bury, a compressed cork floor covering is in use in the board-room. This has worn well and is very 'easy' on the feet.

All wards should be lit by electricity and the tendency at present is to produce a general illumination by central ceiling lights, and individual wall-lights for each bed. At Manchester the central lights are set in bowls close to the ceiling, giving a pleasant diffuse illumination. The individual lights are best provided on wall brackets, some 8 or 9 inches from the wall, and at a height of about $3\frac{1}{2}$ feet above the pillows to allow the patient to read comfortably without sitting up. Those are in use at most of the new hospitals (Hobday).

An added convenience/

An added convenience would be a coloured night light, which is lacking in many places.

Several methods of heating wards are in use. These are best discussed separately.

Perhaps the most economical method, and that in general use, is central heating of all wards from one boiler-house, pipes being run underground to each ward. Radiators are placed under each window, which have lower sash-boards directing the incoming warmed air upwards. Heating may be provided by steam, which may be under high pressure or low pressure, with radiators as described. On a low pressure system 12 feet of piping is required per 1000 cu. feet of water at 212°F. Under high pressure systems, steam at 300°F. is supplied with 8 feet of piping per 1000 cu. feet of steam.

High pressure piping is much smaller in bore, requires to be covered or run high up near the ceiling (Salford) and tends to dry the air in the vicinity too much. It is for this reason that Hobday advocates the avoidance of steam heating in wards.

Another idea is the enclosing of the piping in the walls to give 'panel' heating, as is being done in modern operating theatres,/

operating theatres, as at Tynemouth Jubilee Hospital. The expense in connection with this, however, can hardly be justified for wards but may be for an operating theatre.

Hobday mentions the use of hot water "Rayrads" or flat radiators as producing a gentle radiant heat which does not char the air.

Finally, there is the introduction of recent years of electric heating. Small electric radiators can be fitted into the walls, are easily cleaned and give a pleasant radiant heat. One ward at Fazakerley Hospital, Liverpool, is entirely heated thus, but the costs of running are very high. At Bradford City Hospital, built in 1869, many reconstructions have taken place to cope with modern ideas of treatment and here small electric radiators have been installed in side-rooms and bath-rooms. Running costs per fire may, in cold weather, be as high as 3d. per hour. In addition, a coal fire set in a tiled fireplace at one end or side of the ward is a pleasant and cheerful aid to the heating arrangements.

Many of the older hospitals have central stoves - as Shorland' or Musgrave's - with down directed flues. These take up/

These take up ward space and are not really necessary.

Gas fires are expensive, tend to char the air in the vicinity and may give out fumes. These are met with in very few instances, but have been used in the reconstructed cubicles at Bradford.

Stanley Banks [24] gives as his opinion of the best method of heating, central heating with automatic thermostatic control, such as is in use at Mill Road Hospital, Liverpool. With this, the writer is in agreement.

One bathroom should be provided for every 12 beds according to Parsons. [11] The bathroom can be set off the sanitary annexe with a sliding shutter in place of a door, thus allowing the space to be utilised for other purposes when not in use for bathing. This type of bathroom is in use in the new hospital at Knightswood, Glasgow. Greater natural lighting in the annexe is allowed by this method, when the bath is not in use.

The ward administrative unit comprises a Sisters' Office, and a Kitchen Duty-room which, as already shown, may overlook both wards of a pavilion. In most places a larder food cupboard is in use. Hobday suggests that this should be/

this should be omitted and a small electric refrigerator installed.

In many cases, for sterilising crockery, a steam-jet in an ordinary sink is installed. The ebullition produced is not proof of boiling and the temperature of the water near the nozzle is about 210°F. while round the sides of the sink it may be only 208°F. 39) In the writer's experience of this type of steriliser, at Bury, no untoward effects have, however, been traced. But, at Manchester, a steam bowl steriliser in the form of a cylinder set in the wall, with a flushing jet, and steam under pressure, is in use

Thus, wards should have both hot water and steam laid on. A gas, or electric cooker for heating up food should also be installed. In addition, each ward unit will require a maids' pantry, linen room, store for patients' clothes and the W.C. for the staff.

Amodern tendency is to wire the wards for power as well as lighting, plugs being inserted in the walls above a few beds for the use of ultra-violet lamps, electric hot baths, etc. (Banks[24]).

In older wards/

In older wards height has been regarded as of prime importance, but now wards are rarely built more than 12 or 13 feet high.

Roof-ridge ventilation, and auxilliary wall openings such as Tobin's tubes and Sherringham valves are quite unnecessary, sufficient ventilation being effected by the ordinary Hinckes-Bird windows, and fireplaces and doors.

Various mechanically opened windows are in use. At Bradford, the lower half of the window is fixed and the upper halves of all windows along one side of the ward are opened by the movement of a lever in the duty-room. This is intended to prevent draughts by opening one side according to the direction of the wind. The fact that individual windows can not be opened seems a disadvantage, however.

In the new cubicles at Belvidere, Glasgow, windows which open in various sections by the action of a lever are in use, while in the corridors are self-retaining windows which open outwards.

THE SANITARY ANNEXE:

This should consist of a/

THE SANITARY ANNEXE:

This should consist of a central sink-room, with a slop sink, steep-sink for soiled linen, and a slab for scraping linen (McMichael). A bed-pan airing chamber is essential, with racks consisting of wood strips which are heated by hot piping, and a rack for water-proof sheets. There should also be a gas incinerator for waste (McMichael [43]), and a small ventilated balcony for the soiled linen receptacle. The soiled linen is collected from outside through an opening on the ground level and thus is not carried through the ward. The bathroom may be off set from the annexe corridor as already described. An important thing is the provision of adequate space and lighting. In many places, as a whole, the annexe is far too cramped.

An addition in the modern annexe is what might be termed the 'clinic'. A sink is provided with a urine-testing cabinet above it. This cabinet can be built into the wall and provides space for chemicals and urine-glasses. A very neat arrangement can be seen set in a tiled wall at Monsall Hospital, Manchester.

A small electric instrument steriliser should be provided/

provided for every ward.

For the entertainment of the patients, wireless is provided in the modern hospital. A loud speaker is installed in every ward at Bury, but can only be used in certain circumstances. A better arrangement would be individual head-phones, which, if sponged with carbolic after use by each case, should be quite a safe proceeding.

Many innovations in ward equipment are to be seen. Beds with tyred wheels can be used for ease in transporting the bed to the sun balcony. Beds which can be readily tilted by mechanical devices afford postural treatment for special cases. Light, curtained bed-screens also equipped with tyred wheels are an advance on the older, heavier types of screen.

Bed-pans should be of the shallow, flattened type, and can be obtained in monel metal or stainless steel. These are expensive as an initial outlay, but should give excellent service. It is important that bed-pans should be adequately sterilised after use, and with a steam steriliser, a saving in the number of bed-pans can be effected. In certain wards, one bed-pan per individual case is/

individual case is urged by many people (notably in barrier and puerperal wards). With efficient sterilising of bed-pans after use, this seems to the writer to be quite unnecessary.

At this stage will be discussed the housing of the various infections, with a note on the best means to be adopted in each case.

SCARLET FEVER:

If the modern view of the aetiology of Scarlet Fever be correct, it would appear, as McMichael [43] suggests, that the ideal way of nursing Scarlet Fever patients would be to barrier or cubicle nurse each case. This is a huge undertaking, and not, in the writer's experience absolutely necessary.

The main consideration in preventing cross-infections is the adequate spacing of beds, and the care exercised by the nurse in attendance. The evils attendant on over-crowding wards are well known to administrators. There is first of all the added risk of spray-borne infection, especially from septic throat cases. If the sanitary annexe is/

sanitary annexe is far away and a nurse has too many cases to cope with at one time, there is a tendency on her part to neglect to wash the hands before proceeding to the next case. It would, therefore, be a kindness to both staff and patient to provide, say, two permanent wash-hand basins with hot and cold water supply, along the axis of each ward, as will be seen at the London North-Western Hospital. Modern basins are fitted with long-handled taps which can be turned on by the pressure of elbows, obviating handling by the nurse. Ready access to running water is the most useful way of ensuring safety from cross-infection.

The next important item is to realise the danger from septic cases. These should be nursed on the verandah, or better still, removed to a separate ward where they can be barrier-nursed.

Barrier-nursing entails a relatively large staff and, hence, it is an economy to have the septic cases all together. In practice, at Manchester, it has been found sufficient to provide a separate ward for cases of otitis media, to nurse cases of rhinitis and sores of the skin on the verandahs, and to keep the open ward for the milder clean cases. Malignant, toxic cases/

Malignant, toxic cases can be treated in side-rooms or cubicles.

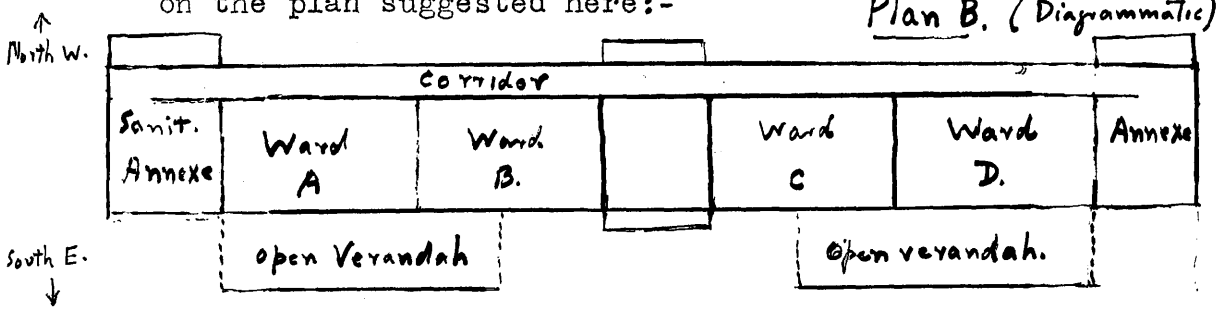
With regard to bed spacing, the Ministry of Health recommendation of 12 feet between heads is rarely adhered to in practice, and one finds that beds are interposed on the plea of urgency between existing beds, making a space of 6 feet between heads. Rather than that this should happen, it would be better to set up a new regulation of 8 feet or 10 feet which would prove sufficiently safe and, at the same time, allow of more beds in the wards.

Given adequate bed-spacing and washing facilities, the ward pavilion outlined on Page 81 should prove sufficient for the nursing of Scarlet Fever cases, without the occurrence of cross-infection, provided always, that septic cases are nursed apart in a similar ward.

There is a great deal to be said for building smaller wards than those in general use. The argument in favour is that if the ward becomes cross-infected with a highly infectious illness such as chickenpox, fewer cases are exposed to the risk. Again, greater facilities for/

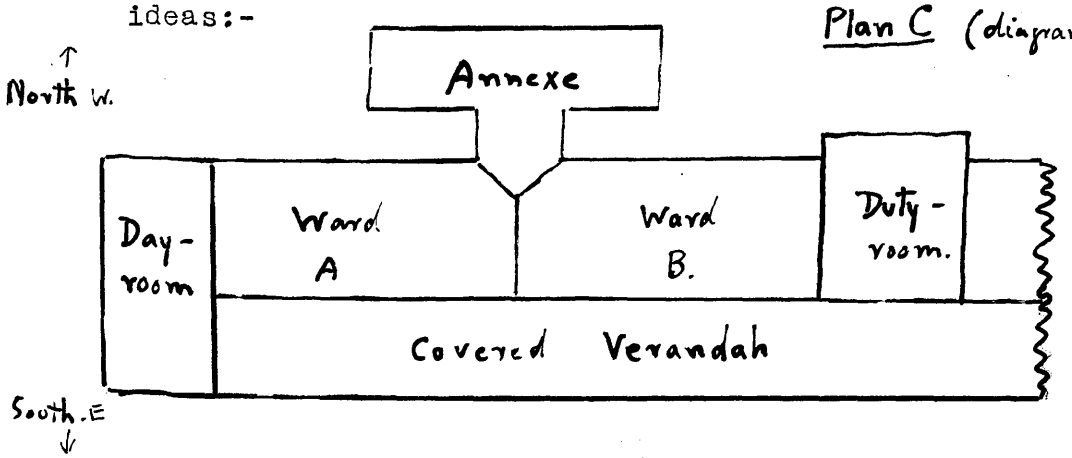
facilities for classification of cases are offerred. New pavilions at Knightswood, Glasgow, have been built on the plan suggested here:-

Plan B. (Diagrammatic)



Four wards, each holding about ten beds, are placed in line, with a partly enclosed ~~verandah~~ corridor along one side of the whole. Large sanitary annexes are placed at the ends. This arrangement requires added supervision but is to be strongly recommended. Criticism might be levelled at the position of the annexes, as wards B and C are some distance away. An arrangement such as suggested here would be more convenient, and offers scope for further ideas:-

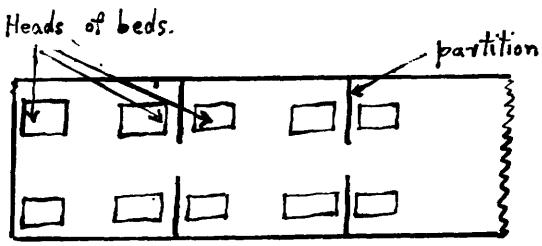
Plan C (diagrammatic).



Again, with the/

Again, with the provision of a central wash-basin, cases could be readily barrier-nursed, thus approximating to the ideal of separation of each scarletina case. The ends of the pavilion are free to be used as solaria, stores, etc. Again, fresh cases might be admitted to wards B and C and transferred to A and D for convalescence; or one ward might be used for children, the other for adults. This type of pavilion might be built as a double-storey and would prove quite suitable for the nursing of cases all of one disease. A greater risk of cross-infection is, of course, involved and for this reason, where ground space permits, the single-storey is to be preferred.

A great saving of space could be effected by building partitions of wood and glass at right angles to the ward axis, so that the beds lie parallel to the side-walls, as illustrated here:-



Plan D.
(Diagrammatic).

The partition should/

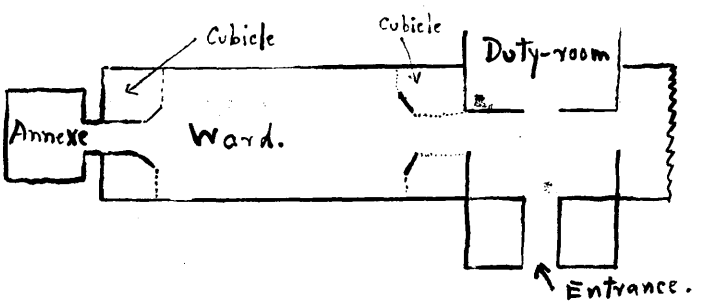
The partition should act as an efficient barrier between the heads of beds.

.....

We come now to consider ways in which existing wards can be re-constructed to approximate to ideas already mentioned for new hospitals.

Where samitary annexes exist at the ward end, wash-basins can be provided along the axis of the ward. The London North Western Hospital has anything up to four such basins in one ward of 40 beds.

Side-rooms can be added to a ward-end which is free, but where this is not possible, wood and glass partitions can be erected in the ward to form a separate cubicle, as follows:-



Plan E.
(Diagrammatic)

Sun balconies can be erected, after the style adopted at Edinburgh. (see page 80).

Lastly, partitions could be erected as in Plan No. D (Page 96)

The difficult point/

The difficult point now arises as to whether provision should be made for convalescents. In the older hospitals, the case must just sit about the ward, around the stove, or at one end of the ward perhaps, and always liable to contract a "re-infection" from bed-patients.

In the view of some medical officers, a day-room should be provided. This could either be situated at one end of the ward (single-storey), or as a separate room on a second floor above the ward entrance (double-storey). This has been done at Markfield, but in practice is seldom used as there is plenty of ground space around and the children play in the open most of the time. It would be useful in doubtful weather. In other hospitals, the children are taken for walks at intervals by the nurse.

We must pause to consider if the day-room is a wise provision. If there are several cases convalescent, each with a different strain of streptococcus in the throat, re-infections might occur. The question is one of care in selecting the time when the case is ready to be allowed out of bed.

In most of the/

In most of the larger City Hospitals separate Convalescent Wards are provided. A special grass playing-ground is put at the disposal of convalescents in Bradford City Hospital.

This question will be gone into in the chapter on administration, but let us note at this point, the provision of day-rooms, convalescent wards and sun-rooms.

DIPHTHERIA:

The Diphtheria pavilions should be modelled on much the same lines as the Scarlet Fever ones, but here, certain additions are required.

In view of the success of steam treatment for Laryngeal Diphtheria, steam should be carried on to the wards by piping running under the floor boards to open at a jet either beside a bed at the rear end of the ward, as at Liverpool, London North Western and London North Eastern Hospitals, or beside the bed in a side-room as at Bury. A small tracheotomy room whould be provided, with a separate lavatory and steam-steriliser for instruments. Where this is/

Where this is not provided, an improvisation is a shadowless lamp, hung from the ceiling at one end of the ward (London North Western), and the tracheotomy is done on the ward, the bed being screened off.

The modern treatment of laryngeal Diphtheria consists in laryngoscopic examination of the patient, an attempt being made to get rid of the membrane by suction from an electric aspirator. This is followed by intubation, if required, in addition, of course, to serum therapy.

At the London North Eastern Hospital an electric Respirator Machine is in use for cases of diaphragmatic paralysis. This consists of a long cylinder into which the patient is placed with only his head protruding. A bellows arrangement alternates air pressure in the cylinder so as to cause compression on the chest wall of the patient at a rhythm corresponding to normal respiration. The medical officer at the hospital informed the writer that cases had been treated continuously in this for anything up to 15 days. During the past year, four cases had been successfully treated which would, in his opinion, have otherwise died.

There is also/

There is also being tried out at this hospital an electro-cardiogram in an endeavour to determine early heart complications.

These machines are costly and require extra rooms. They show, however, the progress which is being made in the interests of research and strengthen the plea of the writer for larger hospitals in which alone can the expense be justified.

THE RESPIRATORY INFECTIONS:

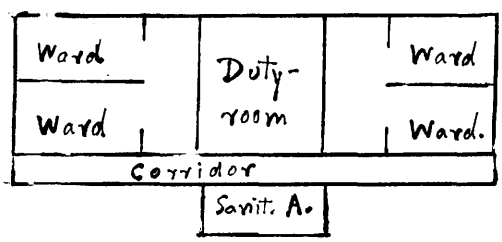
The greatest scope for re-construction lies perhaps in the provision of accommodation for the respiratory infections, pneumonia, whooping-cough and measles. One finds that many hospitals do not admit measles or whooping-cough; again, others only admit those infections to a very limited extent.

In Chapter III, the writer has drawn attention to the claims of the respiratory infections for adequate hospital treatment. In the cities, particularly of Scotland, greater attention has been paid to the complicated cases of measles and whooping-cough, and to pneumonias.

As, in inter-epidemic times/

As, in inter-epidemic times these infections will not be met with in great numbers, a great deal is to be said for the small ward. At Salford City Hospital, one block is set aside for sporadic cases. This consists of a two-storey building subdivided into four wards on each storey.

Plan F.



Whooping-cough cases are found in one ward, measles in another, in the one building. In epidemic times, a whole large ward of anything up to forty beds is used for each of these infections at the larger hospitals.

Now the chief considerations are these. The respiratory infections, with their frequent long complications, require facilities for open-air treatment. Hence verandahs or sun-balconies should be provided. Again, the highly infectious nature of the diseases necessitate proper spacing of beds or means of isolating cases.

In inter-epidemic times/

In inter-epidemic times, cases should be isolated in the cubicle-wards, side-rooms, or, if a few in number, in small wards. Lobar pneumonia, and measles after the catarrhal stage, should be nursed "in barrier".

In epidemic times, separate wards should be given up to each disease and verandahs provided for open-air treatment. Thus, wards otherwise used for scarlet fever might be given up to the measles or whooping-cough cases.

It has been suggested by some that glass partitions should be erected between the beds, but this seems an unnecessary expense. The Plan No. D shown on Page 96 would provide more beds where existing hospitals cannot extend, and would afford segregation of cases.

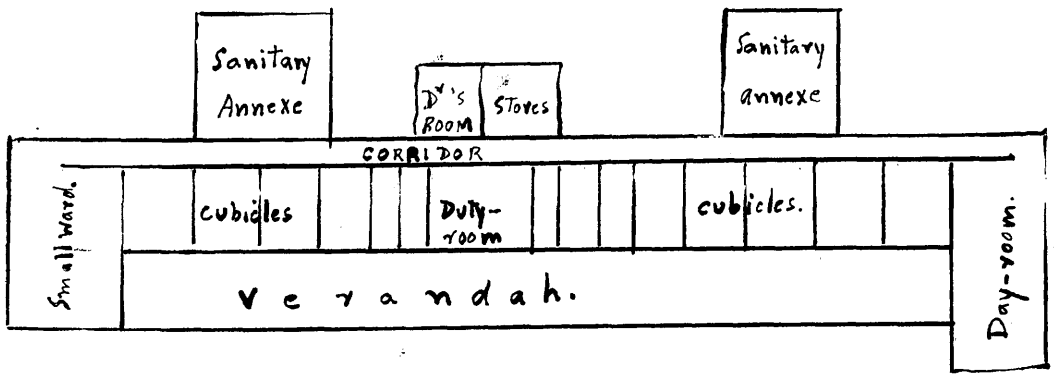
McMichael[43] suggests that two beds, in each ward of ten beds provided for measles, should be cubicled. This arrangement, or side-rooms, is essential in a ward where infection is spray-borne and cases are often incubating two diseases. Given those facilities, however, the Ward Plan No. A should be quite suitable.

The pneumococcus has been shown recently to fall into three types and a heterogeneous group 4.[42] Typing of the causal organism/

the causal organism should be carried out for purposes of serum treatment; but there is a further signifacance. As in the case of the streptococcus, relapses might be really re-infections with a different type and, hence, a certain degree of segregation of cases will be called for.

The ward used at Markfield for pulmonary tuberculosis would also be very suitable for pneumonia cases. Here, eight small cubicles, ranging in size to accommodate from one to three beds, are arranged on either side of a duty-room. The south wall of each ~~dxkx~~ cubicle is closed only by glass doors which can be opened to afford absolute open-air treatment. A completely open verandah with sloping glass roof is provided. The following diagram 47. illustrates the Markfield arrangement.

Plan L.



PUERPERAL SEPSIS:/

PUERPERAL SEPSIS:

At the present time, there is some doubt as to whether cases of puerperal sepsis ought to be admitted to an Isolation Hospital. In some areas they are treated in "septic wards" of Maternity Hospitals and, in others, are removed to the puerperal pavilion of a fever hospital.

In a very excellent book on Maternal Mortality and Morbidity, Munro Kerr[45] states that "it should be borne in mind that they are very costly beds to run. The patients require special nursing, dressings, medicines,etc., and are often in residence for a long period. It is obviously quite impossible, therefore, that all Maternity Hospitals can have a "septic" block with a separate staff who might occasionally have charge of only one or two patients, or even might have periods when there were no patients under their care".

He mentions that"if the Maternity Hospital were in close proximity to a general hospital, the "septic" pavilion might be used for all septic cases, surgical and puerperal. Again, where the cases can not be so housed and removal to a Fever Hospital is carried out an "Obstetric consultative Staff" should be appointed to this particular pavilion."

More depends on/

More depends on the skill and care of the attendants for the recovery of the patients, than on the actual building accommodation.

A room leading off from the ward should be fitted up with a table for treatment, and equipped with means of sterilising dressings, instruments, etc. No very elaborate theatre need be set up, as with sterile gowns, dressings and instruments, and care on the part of the attendants, treatment can be adequately carried out.

In new hospitals, where an observation ward with adjoining theatre is provided, s small ward of some eight beds might be used for puerperal cases and treatment carried out in the theatre.

Here, again, a sun balcony is useful. At Edinburgh, the puerperal ward has two side-rooms and a newly constructed sun balcony.

Modern bedsteads can be mechanically tilted to allow postural drainage. Munro Kerr[45] points out the danger of cross-infection from bed-pans. A steam bed-pan steriliser should be installed in the annexe.

OBSERVATION WARDS:

OBSERVATION WARDS:

We come now to the greatest modern development, namely, the provision of separate cubicles in one block, either as a single-storey or double-storey building.

A cubicle-block has been attached to all the new hospitals, and the older ones are being re-constructed to provide such accommodation.

For diseases such as chickenpox, measles, cerebro-spinal fever, poliomyelitis, encephalitis, whooping-cough, mumps, enteric fever, cases of mixed infection, and contacts with the foregoing, cubicle-nursing is practised as affording the only safe way of completely separating one disease from another to prevent cross-infection.

There are several ways in which this can be done. These will be discussed in order.

(1) An ordinary ward on an upper storey has been re-constructed at the London North Western Hospital to provide 20 single-bed cubicles. The partitions are of wood and glass and reach to the ceiling, thus forming completely shut off rooms. Ten cubicles are placed on either side of/

either side of a central corridor, and each has a separate wash-basin and separate gowns, etc., for each case. A difficulty is ventilation, and an extraction fan is kept constantly working at the far end of the corridor.

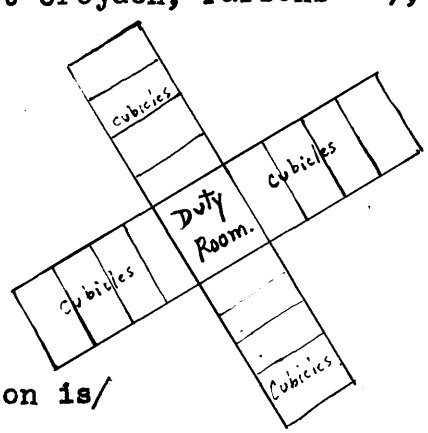
A similar re-construction has been made at Edinburgh but the partitions are left open for a distance of 1½ feet from the ceiling. This gives adequate ventilation and ought to be quite satisfactory.

(2) A double row of cubicles, placed back to back. This does not allow cross-ventilation, and is difficult to supervise.

(3) A double row of cubicles as in (1) but separated only by wooden partitions to a height of 7 feet, as at the London North Eastern Hospital.

(4) A wing-type of four wings each with four cubicles which can be supervised by the nurse from a single duty-room. (In use at Croydon, Parsons[11]), vide diagram:-

Plan H.



An objection is/

An objection is the amount of ground space taken up; but this seems a very good type.

(5) The most useful type consists of a single row of cubicles which may vary in size to hold from one to four beds, and may have an observation ward of six or eight beds. These all open on a single corridor. This arrangement is in use at Glasgow, (Knightswood and Belvidere), Markfield, and Coventry.

At Knightswood, there is a single-storey block of cubicles with an operating theatre at one end and an observation ward at the other. A double-storey block on the same lines can be seen at Belvidere, Glasgow. The cubicles are separated by glass partitions and can be supervised from a central duty-room. The sanitary annexes are placed at the ends. Wash-basins, however, are installed in the corridor, one basin being provided for every two cubicles. A push-bell in the cubicle is also connected to a red warning light in the corridor. The red light does not go out till put out by the nurse after having attended the case.

COMMUNICATION BETWEEN THE WARDS:/

COMMUNICATION BETWEEN THE WARDS:

As a protection to the staff, and for ease in transporting food, etc. between wards, cement ways may be provided, but are not by any means in general use. A partly enclosed corridor with cement walk and wooden sides and roof serves the purpose.

Private telephone systems are now being installed in hospitals, on the "Dial" system. The ward number is indicated on the "Dial" and the caller is automatically connected with the ward.

Also there are various systems in use for obtaining the medical officer on duty at short notice. This may consist of a buzzer, as at London North Western Hospital, or warning lights which flash on every ward as at Markfield. On the Markfield system, the doctor lifts the receiver and is automatically connected with the hospital office.

BARRIER or GENERAL WARDS:/

BARRIER or GENERAL WARDS:

With a properly organised ward and trained staff, many diseases can be treated in Barrier or General wards. Such varied conditions as mumps, erysipelas, ophthalmia neonatorum, enteric fever, measles after the catarrhal stage, as well as scarlet fever, diphtheria and whooping-cough in the later stages, can be efficiently treated side by side.

The criteria to be observed are, in the first place, adequate bed-spacing, secondly, suitable separate equipment for each individual case, and thirdly, an adequate staff of nurses. It will suffice to describe one such system. At Manchester, a movable wooden stand is placed between each bed and, on this, hangs a sterile gown for the nurse and one for the doctor. The staff don these gowns when attending to the patient and wash up immediately afterwards, discarding the gown before proceeding to the next case. Each case has a looker with its own separate utensils, brushes, soap, towels, etc. A small cup on the wooden stand contains the thermometer in a little disinfectant. The stand also has a ring which accommodates a small enamelled basin with antiseptic for the attendant's hands.

Other adaptations/

Other adaptations can be practised. At Newcastle-on-Tyne a small table between each bed has two bowls, one of sterile water and one of antiseptic, with a tray for brush and soap. At the North Western Hospital, London, four fixed basins along the middle of the ward serve the hands.

Rundle[11] treated 741 cases "in barrier" during 1910-11 with only 2 cross-infected cases. The practice allows of sporadic cases of several diseases being nursed together, thus saving ward space, but necessitates a high degree of care and skill on the part of the nursing staff.

In general, diseases in which infection is caused by direct contact, and those where spray-borne infection is of low infectivity, can be nursed in barrier.

A ward of 20 beds will require a day staff of one Sister and five Nurses, and a night staff of two nurses.

In addition, where a cubicle-block is not provided, observation cases, cases of double-infection, or septic cases can be treated "in barrier". Or if the scarlet or diphtheria pavilions are full, a few surplus cases can always be/

can always be put in the barrier ward.

Diseases with a high infectivity from spray-borne infection are not suitable for the general ward. These are measles in the catarrhal stage, whooping-cough in the early stages, rubella, chickenpox and influenzal pneumonia. Each of these diseases are better given separate accommodation.

Again, the diseases of the nervous system, cerebro-spinal fever, poliomyelitis and encephalitis, are too dangerous for one to risk cross-infection. Hence, these conditions are better nursed in cubicles.

THEATRE, LABORATORY, RADIOLOGY, RESEARCH

We come now to the discussion of what might be termed the accessory scientific units of the hospital, comprising the operating theatre, pathological laboratory, dispensary and X-ray rooms.

These are found in a state of incomplete development in most present-day hospitals, and much more work will be done in this direction in the future.

With the admission/

With the admission of a greater variety of diseases, there is more occasion for the use of an operating theatre. In many smaller hospitals a room is fitted up as a theatre when required. The trouble caused and difficulty in sterilising the room are obvious.

The theatre need not be large, but sufficient to deal with the amount of work. It may serve a double function, as at Bradford where the hospital is the school tonsils and adenoids centre. Thus, while the windows are of frosted glass as in general hospitals, blinds should also be provided (to pull down outside the window) for throat and nose examinations. Again, if cases of pulmonary tuberculosis are treated in the hospital, the theatre is constantly in demand for pneumothorax and phrenicectomy operations.

Set off from the theatre is a sterilising-room supplied with hot and cold water sterilisers, instrument steriliser, bowl steriliser and dressings steriliser.

X-ray rooms have been installed in many of the hospitals, such as Liverpool, Markfield, Newcastle and London. Besides pulmonary tuberculosis cases, many occasions arise in/

occasions arise in connection with the fever section of the hospital when X-ray examination is desirable.

A small dispensary is useful and is in many hospitals built in the administrative block, but may be incorporated in the laboratory buildings.

The pathological laboratory is one of the most important items. Chalmers[46] in 1920 stated, "In the interest alike of the community, the state, and the training of future practitioners, a time should come when the epidemic hospital will become an institute for research applied towards the elucidation of the problems with which infectious disease is surrounded."

The writer would like to emphasise the importance of this and will later discuss the possibilities of the laboratory.

The laboratory should consist of a large well-lighted room, preferably facing south or south-east with a broad bench running along one wall which is well lit by windows facing south or south-east, as at Salford or Markfield. The other wall benches accommodate electric incubators, water-baths, an autoclave, sinks and wash basins. Provision is made for the preparation of/

preparation of media, sterilisation of containers and the culture of organisms. The new hospital at Knightswood, Glasgow, is equipped with animals for innoculation tests for diphtheria, typing of pneumococci, and animal experimentation in general. There are also several rooms for laboratory testing, three large incubators, and an autoclave. Offices and storerooms for appliances and drugs are also required and provided here.

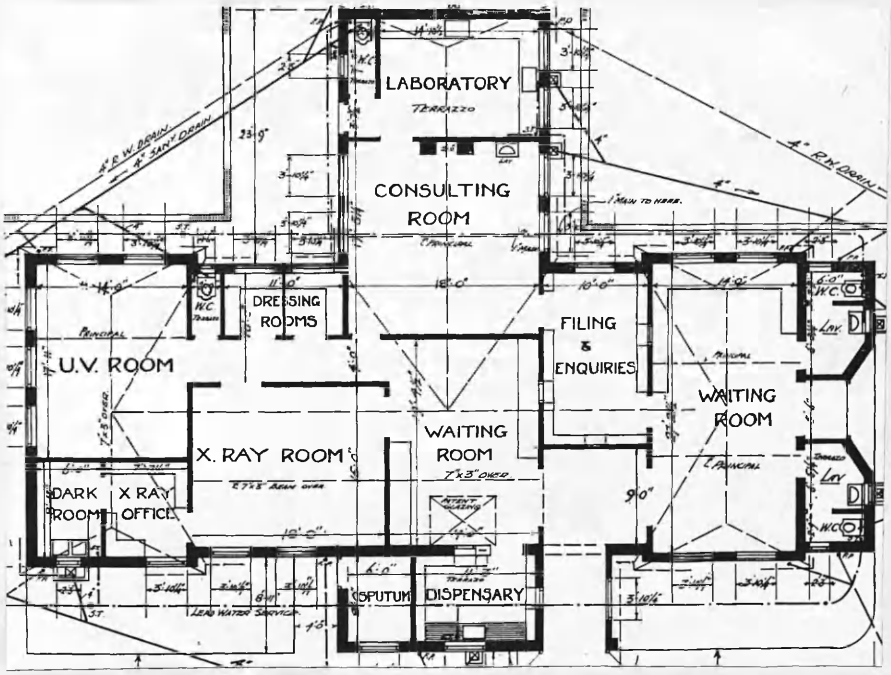
Now the question arises as to where best these various accessory units can be placed in the general hospital scheme.

At Knightswood, the theatre is built as part of the observation pavilion, an arrangement which seems entirely satisfactory, as beds are required close to the theatre for the recovery period after operation. At Markfield, the accessory units are built together in a "Pathological Block".

In addition to the theatre and sterilising-room, X-ray-room, dark-room, and laboratory, one would include an enquiry and record office, consulting-room, waiting-room for patients,/

for patients, dressing-rooms, and lavatory accommodation for patients and staff.

A neat arrangement is shown in the following plan of Markfield Hospital:- 47.



In University Centres, lecture-rooms are provided for undergraduates, and students of public health.

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MORTUARY, LAUNDRY, BOILER-HOUSE:/

MORTUARY, LAUNDRY, BOILER-HOUSE:

These are almost universally built together towards the northern end of the hospital and approached by a separate hospital entrance.

A separate receiving room should be provided apart from the mortuary. The post-mortem room may have a small balcony above with shelves for pathological specimens. Post-mortem tables are built of either porcelain or slate. A slate bench with sink is useful for examining specimens and can easily be hosed down. Many places have only a wooden table for this purpose, and this is not satisfactory.

In the laundry great use is now being made of electricity. Washing-machines, hydro-extractors, and rollers are all elctrically driven. Electrically heated irons are in general use. Drying rooms are built in the laundry and the actual drying done by parallel rows of hot pipes. Labour-saving devices are used to a large extent. There are also steeping-sinks for boiled linen and, in most places, a Washington-Lyon Disinfecting Machine.

The laundry should be well ventilated, and the floors built of cement.

The boiler-house is/

The boiler-house is usually attached to the laundry, and provides two systems of heating, steam and hot water, which are led by piping underground to the various buildings.

Incorporated in the above buildings should be the garage for the hospital ambulance. In some cities, where several hospitals are served, the ambulances are not kept in the hospital but in an outside ambulance station. The modern ambulance may cost as much as £2,000, and is a powerful, well-sprung vehicle, built for travelling speedily with a minimum of discomfort to the patient. In these cars patients amy be transferred for anything up to twenty miles or so without ill-effects. The ambulance is, of course, washed down and disinfected after each case.

ADMISSION and DISCHARGE BLOCKS:

The Admission and Discharge Blocks which were at one time thought necessary can now be dispensed with on the following grounds.

In the London County Council hospitals and at Manchester, a separate receiving room/

a separate receiving room is provided for scarlet fever cases, and one for diphtheria cases, while all others are seen by the medical officer in the ambulance. Now, to carry out this system properly, many rooms would be necessary. Again these rooms might easily be sources of cross-infection. Lastly, there is no reason why all cases should not be seen first of all in the ambulance.

With regard to discharge blocks, the modern tendency is to discharge the patient straight from the ward. At Knightswood, Glasgow, Bradford City Hospital, and Liverpool, no discharge blocks are used. A discharge block was built at Bury but has not been used for the past 20 years. At Manchester, the discharge ward is still used and cases stay for two days in the ward before discharge. They are seen by a responsible medical officer who may send the case back to the ward if not, in his opinion, ready for discharge.

If, however, cases are seen by a responsible officer, they can be discharged straight from the ward without any detriment. The patient should be put to bed again for two days prior to his discharge, during which time his clothes are being disinfected. Care is then taken that no contact is made with other patients before leaving the ward.

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CHAPTER V.

A D M I N I S T R A T I O N

"Silently, as a dream, the fabric rose;
No sound of hammer, or of saw, was there."

COWPER. The Task. Bk.V. Line 144.

.....

THE STAFF:

Scattered throughout the country are many small fever hospitals. These, for economic reasons, are unable to afford facilities for treatment as outlined in the preceeding chapter. In this respect, much could be done to improve matters by the union of smaller districts, resulting in larger hospitals with accumulated financial reserves at their disposal.

As already pointed out, modern transport and lines of communication allow of much wider areas being served than formerly. Hospitals of anything from 200 to 500 beds should be aimed at; but a hospital of over 500 beds tends to make administration difficult.

The medical staff/

The medical staff of the fever hospital should be of two orders - (a) resident and (b) consultant. The resident staff should consist of a medical superintendent and assistant medical officers in the ratio of one per 100 beds.

Administration is not uniform throughout the country but is carried out in one or other of the following ways:-

(1) CITY HOSPITALS:- by a medical superintendent, who is in full charge of the hospital and acts in the role of consultant physician to the junior officers. He collaborates with the Medical Officer of Health on the broader principles of hospital construction and administration.

(2) HOSPITALS of TOWNS and BOROUGHS:- Here, the Medical Officer of Health is the official head of the hospital and the consultant physician. Such hospitals will then have - senior and junior resident medical officers.

(3) HOSPITALS of JOINT DISTRICTS:- These are supervised by a medical superintendent as in (1) but acting on behalf of a Joint Hospital Board, or of a Hospital Committee in the case of Administrative Counties.

Much depends upon the personal attributes of the medical superintendent. He must be able to advise his committee how to cope with modern requirements, and to this end, must keep abreast of the results of recent research. The internal economy of the hospital rests largely on his shoulders. He has it in his power to encourage or discourage his/

encourage or discourage his junior officers according to the amount of enthusiasm he himself displays. He should, therefore, be one who, while having specialised in Zymotic Diseases, has had a broad earlier training in General Medicine.

The tendency now is to reserve the posts of junior medical officers for such candidates as intend to make preventive medicine their life-work, as judged by their possessing a Diploma in State Medicine. The junior medical officers should be encouraged to take up some form of private study for the higher medical degrees. Thus, where possible, particular cases can be apportioned to the officer most interested in them, so ensuring a high standard of efficiency.

Most isolation hospitals are now appointing consultant staffs for emergency cases. A general surgeon, ear nose and throat surgeon, ophthalmic surgeon, and obstetrician should be appointed. Much can be said in favour of the appointment of a consultant pathologist, for the average medical officer is scarcely sufficiently experienced in post mortem examinations to make an accurate interpretation of the findings. These consultants could be the same as/

be the same as serve the local general hospitals, and in themselves would serve as a means of linking up the various local services.

What has been said regarding the abilities of the medical superintendent might equally apply to the Matron. The Matron and Sisters should have had some previous experience of isolation hospital work. The reputation of the hospital rests to a large extent on the work of the nursing staff. They are the persons directly responsible for the spread or control of cross-infection in the wards. It would be most unfair to level criticism at the work of the nurses, unless we provide -

(1) wards with proper facilities and equipment as already discussed,

(2) facilities for the teaching of the staff.

In small hospitals which are not recognised training schools and where little or no attention is paid to this branch of the work, it is little wonder that cross-infection is common.

Modern hospitals have Tutor Sisters, who also act as Home Sisters or Assistant Matrons, and are responsible for the education of the nurses. The necessity for a suitable lecture-room - laboratory, where the nurses can also practice cookery, bandaging, and side-room work, is obvious.

At the same time/

At the same time, where a hospital is under-staffed many ills may befall. Over-worked nurses tend to be neglectful of the common rules of prevention of cross-infection, and are also more liable to contract illness. It has been suggested that one nurse should be provided for every five beds on an ordinary ward, and one to three beds on barrier and observation wards. The Glasgow hospitals are most generously provided for in this respect in having an average of one nurse to three beds over all wards.

Now a fever hospital is not full all the year round and work may be very slack at certain periods. Hence, the tendency in the smaller hospitals has been to appoint say about one nurse per eight or nine beds. This may be sufficient in summer for a hospital with half its beds occupied, but it is totally inadequate in the winter time and during epidemics. It would be much better to strike a mean and have one nurse per five beds, emergency staff being appointed in epidemic times. This could be done by having an agreement with the local general hospitals for the transfer of nurses when required. Again, some hospitals appoint private nurses when occasion demands.

There has been a move in some quarters for the institution of an eight-hour working day for nurses. This is a reform which is long overdue. If adopted, it/

If adopted, it would necessitate larger staffs and a vast amount of work for administrators in planning duty-times and holidays. In many places, nurses work for as long as 70 hours per week, a state of affairs which should not be allowed to exist.

With regard to the protection of the staff against illness, it is the usual practice to Schick and Dick Test nurses, and to actively immunise susceptibles. Nurses are also inoculated against Typhoid fever in some hospitals, but not in others, the argument being held that nurses so inoculated tend to be careless in handling the patients. This would appear to be no reasonable excuse for exposing the nurse to personal risk, if a means of safety is at all available.

In the writer's experience, nurses have been much more prone to take scarlet fever than diphtheria, and especially so within the first week of taking up duty, before immunisation could be properly instituted. The following ways of preventing this have occurred to the writer.

(1) Probationers could be immunised with alum-toxoid (single-injection) and begin work on the diphtheria pavilion first.

(2)/

(2) Could begin on the convalescent wards or wards other than scarlet fever and diphtheria while undergoing immunisation.

(3) Could be Schick and Dick Tested at the first interview, on appointment, and immunised before taking up duties.

With the new work which has been done on the streptococcus problem, the value of active immunisation in scarlet fever might be queried. It will suffice to quote here the general view of the results of such immunisation.

"The general results of immunisation have, however, been very satisfactory, especially in fever hospitals, where the incidence of scarlet fever among nurses has been markedly reduced." (Dible [42]).

The necessary provisions for the social side of the nurses' existence have already been discussed. A study room and library would be an added advantage.

Much of the danger of cross-infection comes from the new probationer. Under the present system a nurse completes a two year course for her Fever Certificate or may come as a trained nurse for one year for the Certificate. The writer has had some experience of lecturing to nurses for both parts of the certificate and has formed one or two opinions with regard/

opinions with regard to the nature of the course.

In the first place, a beginner receives a great deal of academic instruction in anatomy and physiology, in order to conform to the syllabus of the Nursing Council, knowledge which is never required for examinations or ward work, and which could be conveniently omitted in order to substitute a few lectures at the beginning of the course, on methods of conveyance of infection and the nature of infection.

Again, in many instances, nurses stay on duty in one ward for far too long a time and may complete their period of study without having had a proper all-round practical experience.

Indeed, in some quarters it has been suggested that a re-organisation of the course will be made and nurses will be compelled to take a general training first, thus spending only a year of study in the Isolation Hospital.

In order to prevent infection being carried from the wards by the staff, light gowns should be worn over uniforms while the staff are on duty and left on the ward afterwards. In Bradford, the nurses from the various wards wear differently/

wards wear differently coloured uniforms as a means of preventing them from going on wards where they do not ordinarily belong.

As with nursing staff, the domestic staff will require testing and protection against infection. Here, again, over-alls may be provided on the ward for the use of the ward-maids.

As a rule, the number of domestic staff appointed is about one half of the nursing staff. A separate Maids' Home should be provided with a suitable recreation room.

In the dietetics department the tendency is to appoint trained 'lady-cooks', and many are in favour of male cooks.

The heating arrangements of the hospital should be under the care of a qualified engineer. Porters and gardners are appointed according to the amount of work and local conditions.

When possible, the clerical work of the hospital should be taken over by an office staff. In many small hospitals the medical officers do the office routine work, but this is not/

but this is not satisfactory as, under this sytem, much time is taken up which could be better devoted to medical duties.

Lastly with regard to hospital records, no uniform method of note-taking is in use; but commonly a temperature chart and case record sheet are hung on the end of the patient's bed and transferred to the office on the patient's discharge. From these, records are made on cards which are appropriately perforated so that they can be sorted out very rapidly by a machine when statistics of any particular item are required.

ADMISSION of CASES:

Cases are admitted to hospital now through the medium of the Public Health Department. The patient's doctor notifies the local Medical Officer of Health who communicates with the superintendent of the hospital. The superintendent, if agreeable to admit the case, instructs the ambulance driver, who proceeds to the address given, accompanied by a nurse. The nurse has a "history sheet" on which particulars regarding name, address, age, and sex of the patient, together with certain details of the mode of onset of/

mode of onset of the illness are recorded. It is important that the nurse should obtain the parent's consent to any operative emergency procedures, such as tracheotomy, together with consent to the immunisation of the child if considered necessary while in hospital. A very important detail which the nurse must not overlook is to enquire whether the patient has been in contact recently with any other cases of infectious disease, i.e. other than that for which the patient is notified.

While this is the method of admission in common use, certain variations must be considered. A practitioner should have the right of communicating directly with the hospital in cases of urgency, such as severe diphtheria, cerebro-spinal fever or anthrax, etc., as much valuable time might be lost in communicating with the Medical Officer of Health, especially at week-ends when the Public Health Department is closed.

Again, as all administrators are aware, a position of dual authority in a hospital leads to much unnecessary friction; so, while the Medical Officer of Health is the virtual chief of the health service, he should not interfere with the internal administration of the hospital, and the medical superintendent should have the right to refuse admission of cases where he considers that he has not the necessary, suitable accommodation. Where the Medical Officer of/

Where the Medical Officer of Health is also in charge of the hospital, this point will not arise.

It is of importance, however, when one reflects on the state of affairs existing in the case of a Joint Hospital Board. The various authorities contributing to the upkeep of the hospital naturally desire a certain amount of control, but a state of chaos will arise unless the medical superintendent be given a free hand in the internal administration.

In epidemic times, the discretion of the Medical Officer of Health must be relied upon, particularly in cities with several hospitals. Where possible, as many cases of scarlet fever should be admitted to hospital as can be taken, because one has seen even mild types which, after two weeks home treatment, have developed complications, such as nephritis, and been sent to hospital. Where, on the other hand, measles and whooping-cough are epidemic, these claim consideration as has already been emphasised. Here mild cases of scarlet fever should give place to cases of respiratory infection which are complicated, or which occur in bad home surroundings, or where removal might be expected to effect, to some extent, the spread of the epidemic.

Now, it has/

Now, it has already been seen that over-crowding of wards with cases of scarlet fever is to be avoided. The writer is of opinion that the recommended distance of 12 feet between heads of beds is not really necessary in the case of some infections. Where clean cases of scarlet fever are nursed together, a space of 8 or 10 feet should be sufficient, while with cases of diphtheria even 7 feet is a safe figure. Where septic scarlet cases, and respiratory infections are concerned, the full 12 feet should be preserved. Ways in which ward accommodation can be increased have been discussed in a previous chapter. It will be noted, therefore, that while as many cases as can be reasonably received in hospital, should be admitted, they are taken primarily on their individual claims to treatment and not from any hope of thereby cutting down the spread of an epidemic.

In London and Liverpool, when epidemics break out in any part of the city, the hospital in the vicinity ceases to admit anything but the worst cases of the prevailing illness, be it measles, whooping-cough, scarlet fever, or diphtheria, while the other illnesses are sent to the other hospitals.

Again, when/

Again, when infectious disease is not prevalent, by concentrating on one or two hospitals, the others might, in turn, close some wards for decoration or repairs.

In London, one hospital is set aside for convalescent scarlet fever cases. This requires neither the extent of staffing nor equipment necessary for the other hospitals and can be regarded as an economy.

Thus it will be seen that while one might suggest that, say 40 beds should be reserved, in a 400 bed hospital, for measles and 40 for whooping-cough, such figures are purely arbitrary and depend on the relative prevalence of the killing diseases. Thus it follows that the control of the individual cases must lie entirely with the practitioners and the public health authorities.

It is opportune here for one to press for greater co-operation between the practitioner and the health official. The practice is developing for the Medical Officer of Health to send an officer to inspect the premises of the notified case with a view to deciding whether it can be suitably nursed at home, when hospital accommodation is limited.

The human element/

The human element unfortunately creeps into the relationship of the two doctors only too often. If greater publicity were given to three rules, a great deal of unnecessary friction would be avoided, and the practice of selection of cases for hospital be much simplified.

(1) The matter should be regarded as one purely of hospital accommodation.

(2) The public health officer should bear in mind the difficulties of general practice, and go slowly in airing his opinion of the diagnosis; but confine himself to the suitability or otherwise of home treatment.

(3) The practitioner should not press the question of hospital treatment with the relatives until after consultation with the public health officer, unless in emergency cases.

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LENGTH of STAY in HOSPITAL:

Cases are kept in hospital no longer than is absolutely necessary, as the danger of cross-infection can never be entirely eliminated. The following table shows the average length of stay of infections at various London Hospitals:-

Period of Residence (in days)[17] Recovered cases only.

	Cerebro-sp. Fever	Diph.	Diph.(Bact.)	Measles	Sc. Fever.	Wh. Cough	Enteric.
North Eastern.	—	72	60	31	62	70	—
North Western.	—	57	37	21	49	62	47
Grove.	63	56	42	36	52	79	55

The average/

The average length of stay gives, therfore, only a general impression of the nature of the illness at the time. The average length of stay of diphtheria cases in Bury during 1933 was 29.8 days, most of the cases being of a mild character.[48] The criterion of discharge is the presence or absence of bacilli in the throat or nasal passages, and most hospitals insist on three negative swabs at ~~weekly~~ of a few days. (A.T.C) intervals. This, again, is only a report of the presence of diphtheria bacilli, and, unless a virulence test is to be required in each case, of doubtful value. Terminal swabbing, except in special cases, has been discarded at Bury during the past two years without a single return case being admitted. This may be simply chance but it certainly tends to show that terminal swabbing is no vital necessity and with progress in the protective inoculation of children, it should become even less of a necessity.

The greatest change in this section in recent years is in the length of stay of scarlet fever cases. Formerly, all cases were kept for at least six weeks. Desquamation is now regarded as a non-infective condition and the condition of the throat and nose, or presence of septic foci, regarded as the important points. Clean cases are rarely kept in hospital/

kept in hospital longer than four weeks, without any detrimental effect on the return case numbers. In the writer's experience, the cases which have been productive of return cases have been, for the most part, in hospital for six or even eight weeks, with large tonsils or some other abnormality of the throat or nose. In such cases, removal of tonsils and adenoids should reduce the carrier rate. The wholesale removal of tonsils is not to be advocated, but cases selected carefully. [49]

With progress in methods of typing streptococci, swabbing should become of practical value both for classification of cases and for determining suitability for discharge.

This leads one to consider again the question of convalescence of scarlet fever cases, and the prevention of "relapses". It has already been shown that many hospitals are providing day-rooms, playgrounds, and convalescent wards. This leads to a mixing of cases which, as a rule, is a safe proceeding, if care has been taken in pronouncing cases as ready for convalescence. Here, the presence of enlarged tonsils should be taken into account, and swabbing for the presence of haemolytic streptococci should be of value. Again, the waiting time between the/

time between the patient's getting up out of bed and being discharged, should be cut down to a minimum. If cases are allowed to convalesce in the open wards, it is difficult for the nurse to be sure that a child will not stray to a neighbouring bed and play with its infected fellow-patient.

The ward plan shown on page 95 should be useful as cases can be moved through from the one small ward to the other for convalescence and the day-room can be built on to the convalescent section.

TUBERCULOSIS and the FEVER HOSPITAL:

Cases of pulmonary tuberculosis are better sent to a separate sanatorium. It is argued by some that the presence of phthisis cases in fever hospital leads to the production of better all-round physicians. On the other hand, the situation of a fever hospital is not always suitable for phthisis cases, and again, specialist service can be concentrated with resulting economy, by the establishment of large sanatoria. A few beds may be required at the fever hospital for very ill phthisis cases, which are isolated in the interests of the public health.

PUERPERAL CASES:/

PUERPERAL CASES:

These could be equally well looked after by a Maternity Hospital or by the Isolation Hospital. Where the Isolation Hospital is used, a consultant gynaecologist should be appointed.[45)]

PNEUMONIA:

Cases of pneumonia are largely admitted to the general hospitals at present. The disease has been shown to be one of low infectivity due to specific types of organism.[42)] Its importance as a cause of death has been stressed.[19)] Here are good arguments in favour of extended hospital accommodation, particularly fever hospital accommodation.

SMALLPOX:

Owing to the high infectivity and dangerous nature of this disease, separate hospitals are kept ready at present, though many are standing empty. The hospital can be administered from the fever hospital and a sister and nurses sent out when required.

VISITORS:

Visiting is only allowed when patients are dangerously ill, with, perhaps, two exceptions, puerperal fever and erysipelas. When visiting/

When visiting is allowed, a short stay of some ten to fifteen minutes is insisted upon. The progress of patients is, in general, obtained at the porter's lodge. At Belvidere, Glasgow, a separate room has been in use for many years, where relatives talk with the nurse from the ward over a high barrier, thus obtaining information first-hand. At Bradford, steps are provided up to the ward windows to allow visitors to see the patient in the ward. At Bury, a visitors' room is provided where convalescent patients are brought to talk with relatives through a glass partition. The system of visiting adopted must not interfere with the regular hospital administration and routine. The progress of patients can also be published, by the use of patients' hospital numbers, in the daily press.

COSTS OF MANAGEMENT:

(a) Establishment Costs:- Under this section fall the expenses of ordinary repairs, painting and cleaning, renewal of appliances and furniture, salaries of staff and superannuation expenses, ordinary running expenses such as light, coal, water and rates.

(b) Patient's Expenses:- Here, one must consider the cost of removal of the patient to hospital, food and drugs.

From the total expenditure, the cost per patient is determined. This is done every three months, six months and every year. From dietary sheets the amount of food necessary to be issued from/

issued from the stores is computed. Daily cost sheets are thus arrived at, and from these, weekly cost sheets. If this is done for each item, comparisons can be made and articles used in excess noted together with the reason for same. Periodic stock-taking is carried out by the Matron and the Home Sister. Total costs of maintenance in hospital per patient varies in different hospitals from two to three guineas per week, with food in the neighbourhood of 7/6d. per head per week. Enquiry is being carried out by the Ministry of Health[19] with a view to arriving at economic average costs.

Tenders are invited from traders, through the medium of the daily press, for the supply of articles, and contracts arranged with the successful applicants for a period of six months or a year. Quality of article, price and conditions of delivery must be taken into consideration.

THE LABORATORY SERVICE:

The Laboratory Service may be classified into three groups:-

(1) The Hospital Laboratory: Here, all the ordinary routine work of culturing and typing organisms can be done by technicians under the supervision of the medical staff.

(2) The Regional Laboratory: This term might be applied to the city public health laboratory which carries out animal inoculation tests and work of a special nature for the neighbouring hospitals.

(3)/

(3) The Central Laboratory:- Greater use than ever is being made of the Ministry of Health Laboratory in cases of difficult or special interest. The writer foresees a greater development and co-ordination of the laboratory services of the future.

For the supply of measles serum Group Laboratories have been established at four hospitals in London. For a general scheme of this nature throughout the country, the Regional Laboratories would be best suited for its development.

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DIPHTHERIA CARRIERS.

At present a good number of beds are occupied by such carriers and cases sent in as " sore throat with positive diphtheria throat swab." To investigate such cases thoroughly to show virulent bacilli and thus justify admission to hospital requires time and expense. The admission of such cases should become less necessary as active immunisation becomes more and more accepted by the public.

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CHAPTER VI.

CONCLUSION - THE FUTURE POLICY

"Friendly, free discussion, calling forth
From the fair jewel Truth, its latent ray."

THOMSON. Liberty. Pt.II. Line 230.

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In the foregoing chapters the writer has attempted to show how the isolation hospitals of Britain are developing, and many of the points raised will be found illustrated in the newer and in the larger city hospitals. But, at the same time, it must be admitted that the vast majority of hospitals outside the cities do not conform to these ideas. The small hospital, incompletely equipped and staffed, without proper means of isolating cases, and which rarely admits anything other than scarlet fever and diptheria is only too common. Such hospitals neither affect the spread of epidemics nor the general mortality rates. The chief barrier to their expansion is one of expense.

The writer has made a plea for the establishment of larger hospitals, made possible by combination of areas with greater financial resources.

The control/

The control of epidemics is outwith the scope of the isolation hospital, which remains, primarily as a centre for the treatment of infectious disease.

Admission to hospital should be governed by the claims of the individual case for treatment.

The present enquiry has proved that those principles are being more and more accepted by hospital authorities.

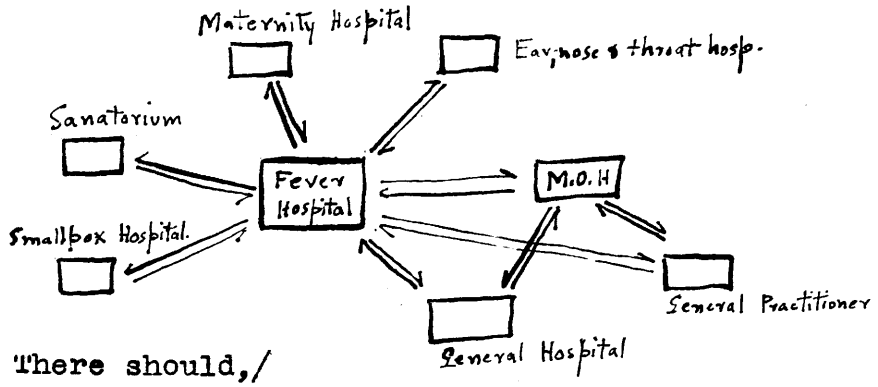
The newer hospitals are being built and equipped to afford better facilities for treatment, and for isolation of cases, while the older hospitals are being re-constructed to fall into line.

There will be in the future greater co-operation between -

(1) The Health Services and the Isolation Hospital.

and (2) between the other Medical Services of an area and the local Isolation Hospital, through the medium of specialist service.

The following diagram illustrates the position of the isolation hospital in a general scheme of Medical Service:-



There should,/

There should, and must be greater co-operation between the general practitioner and the health department, if any real attempt is going to be made to lower the death rate from the major infections, notably the respiratory infections.

The laboratory services will be developed in the future, and will in time, take the shape of a uniform service of local, regional and central laboratories.

Lastly the isolation hospital will develop as the Home of Research for the many problems which beset the control of epidemics.

In conclusion, the writer would like to acknowledge the kindness and courtesy of the medical officers of the various institutions visited, and the readiness with which they offered facilities for the present study.

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REFERENCES

1. "Some Administrative Aspects of Scarlet Fever." Parsons. Public Health Series. No.35. 1927.

2. Fifth Annual Report of the Department of Health for Scotland, 1933.

3. "Investigation into the Health and Nutrition of certain of the children of Newcastle-upon-Tyne." Spence and Charles, 1934.

4. Public Health. No.7. Vol.XLVIII.

5. "Mediæval Hospitals". R.M. Clay (Methuen).

6. "History of Epidemics in Britain". Creighton, 1894.

7. "Black Arrow". R.L. Stevenson.

8. "Hospitals and the State". Chalmers, 1928.

9. "Treatment of the Sick Poor of this Country". H.J. McCurrich, 1929.

10. "A History of St. Bartholomew's Hospital". Norman Moore, 1918.

11. "Isolation Hospitals". H.F. Parsons(Rev. by R.B.Low),192

12. "Textbook of Hygiene". J.R. Currie, 1930. P.451

13. "Cyclopoedia of Medicine". Zeimssen. Vol.2. 1875.

14. "The Continued Fevers of Great Britain". Murchison, 1862.

15. "Hospitals and Asylums of the World". Burdett. Vol.3. p.91.

16. "Vital Statistics". Farr. 1885.

17. Report of the Metropolitan Asylums Board for the year 1929-30.

18. "Fever Hospital Policy and Modern Treatment" Public Health. Vol.45. 1932.

19. Annual Report of the Ministry of Health for 1933.

20./

20. "An Epidemiological Study of Scarlet Fever in England and Wales since 1900".
Hilda M. Woods. M.R.C. Special Reports.No.180. 193

21. "Studies on the Epidemiology of Scarlet Fever". Pope.
American Journal of Hygiene,1926. P.389.

22. Todesco. Lancet. March, 9th. 1935. P.548.

23. "Epidemiology of Scarlet Fever in a Landward Area".
British Medical Journal. 17th. Feb. 1934.

24. Banks "Fever Hospital Policy and Modern Treatment".
Public Health. Vol45. P.101.

25. "Recent Advances in Serum and Vaccine Therapy".
Fleming and Petrie. 1934.

26. Peters. "Diagnosis and Treatment of Malignant Diphtheria".
British Medical Journal. 23rd.March,1935.

27. Underwood. Lancet. Feb. 16th. 1935. P.364.

28. Parish and Wright. Lancet. March 16th. 1935. P.600.

29. "Active Immunisation against Diphtheria".
Dudley, May, O'Flynn. 1934. M.R.C. Spec.Report No.195

30. "Public Health Administration in Measles Epidemics".
Brownlee. British Med. Journal, April 17th.1920. P.534

31. "Epidemiology of Measles in a Rural and in a Residential Area". Picken. Proc. Roy. Soc. Med. 1920.

32. "Enquiry into the Relationship between Housing Conditions and the Incidence and Fatality of Measles".
Med. Research Council. Special Report 120. 1928.

33. "Treatment of Measles".
Gunn. Brit. Med. Journal.23rd.March, 1935. P.597.

34. Harries. "Medical Officer". Feb.15th.1930. P.77.

35. "Housing Conditions and Respiratory Disease".
Smith. Med.Research Council. Spec. Report No.192. 1929

36. Benson. Brit. Med. Journal. March 30th.1935. P.657.

37. Cockshut. Brit. Med. Journal. 1933. II. 819.

38./

38. "A Review of Certain Aspects of the Control of Cerebro-spinal Fever".
Pub. Health & Med. Subjects Report No.65.

39. "The Modern Isolation Hospital".
Hobday. Public Health. Vol46. P.6. 1932.

40. Pickles. Brit. Med. Jour. 1933. II. 817.

41. Stallybrass. "The Problem of Diphtheria"
Lancet. March 23rd. 1935. P.698.

42. "Recent Advances in Bacteriology". Dible, 1932.

43. McMichael. "Planning a Fever Hospital"
Public Health. Vol.46. P.13. 1932.

44. "Prevention of Epidemics and Isolation Hospitals"
McNeill. (Churchill). 1894.

45. "Maternal Mortality and Morbidity"
Munro Kerr. (Livingstone). 1933.

46. "The Functions of the Isolation Hospital in a General Scheme of Hospital Provision".
A.K. Chalmers. Pres. Address. Proc.Roy.Soc. Med. 1920

47. Report by Leicester County Council on the opening of Markfield Hospital. Sept. 22nd. 1932.

48. Annual Report of Med. Superintendent (Dr. J.B. Morton) to Bury Joint Hospital Board, 1933.

49. Debate. "That operations for removal of Tonsils and Adenoids are too often performed without adequate cause".
Tilley, Glover, McKenzie, Ryland.
Post Graduate Journal, Vol.10. No.99. Jan.1934.

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